Golder Associates Inc.

200 Union Boulevard, Suite 100
Lakewood, CO USA 80228
Telephone (303) 980-0540
Fax (303) 985-2080

ENVIRONMENTAL ASSESSMENT FOR THE LAMEFOOT PROJECT PROPOSED DRILLING EXPLORATION PROGRAM

Prepared for:

The U.S. Department of Interior
Bureau of Land Management
Spokane District Office
East 4217 Main Avenue
Spokane, Washington 99202

Prepared by:

Golder Associates Inc.
200 Union Boulevard, Suite 100
Lakewood, Colorado 80228

June 1992

923-2450

Table of Contents

#47744224
88065631
HD
243
.M2
L3564
1992

TABLE OF CONTENTS

1.0 INTRODUCTION 1
  1.1 Purpose of and Need for the Proposed Action 1
  1.2 Background on Lamefoot Exploration and Drilling Program 3
  1.3 Other Required Permits 4
  1.4 Project Overview 4
    1.4.1 Project Location and Access 4
    1.4.2 Project Area 5
    1.4.3 Summary of Project Activities 5
  1.5 Project Schedule 6

2.0 DETAILED DESCRIPTION OF THE PROPOSED ACTION 8
  2.1 Drilling Operations 8
  2.2 Drill Roads 10
  2.3 Underground Exploration (on Private Lands) 10
  2.4 Equipment Requirements 12
  2.5 Fire Fighting Equipment 13
  2.6 Work Force and Schedule 13
  2.7 Office Space and Ancillary Facilities 14
  2.8 Cumulative Project Disturbances Proposed Through 1992 15

3.0 DESCRIPTIONS OF ALTERNATIVES CONSIDERED 17

4.0 AFFECTED ENVIRONMENT 20
  4.1 The Environmental Setting and Site Investigations 20
  4.2 Geology 22
  4.3 Hydrology: Surface and Groundwater Resources 23
    4.3.1 Surface Water 23
    4.3.2 Groundwater 23
  4.4 Air Quality 25
  4.5 Noise 25
  4.6 Wildlife 26
    4.6.1 Information Review 26
    4.6.2 Habitat Overview 26
    4.6.3 Wildlife Species Composition 27
    4.6.4 Rare, Threatened, or Endangered Species 28
  4.7 Vegetation and Wetlands 29
    4.7.1 Information Review 29
    4.7.2 Plant Communities 29
    4.7.3 Rare, Threatened, or Endangered Species 30

TABLE OF CONTENTS (Continued)

Page

- 4.7.4 Wetlands 31
- 4.7.5 Timber and Range Resource 32
- 4.8 Soils 32
  - 4.8.1 Information Review 32
  - 4.8.2 Soil Types and Characteristics Affecting Rehabilitation 33
- 4.9 Visual Aesthetics 34
  - 4.9.1 Composition 35
  - 4.9.2 Quality 36
  - 4.9.3 Condition 37
  - 4.9.4 Visibility 37
- 4.10 Cultural and Historical Resources 42
- 4.11 Socioeconomics 42
  - 4.11.1 Employment, Labor Force, and Unemployment 42
  - 4.11.2 Population 44
  - 4.11.3 Local Government Tax Revenues 44

5.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION 46
- 5.1 Impact Analysis Process 46
- 5.2 Summary of Potential Impacts 48
  - 5.2.1 Potential Environmental Impacts 48
  - 5.2.2 Potential Impacts of Portal #2 50
  - 5.2.3 Potential Impacts of the No Action Alternative 51
- 5.3 Hydrology: Surface Water and Groundwater Resources 52
  - 5.3.1 Surface Water 52
  - 5.3.2 Groundwater 53
- 5.4 Air Quality 54
- 5.5 Noise 54
- 5.6 Light and Glare 55
- 5.7 Wildlife 55
- 5.8 Vegetation and Wetlands 57
- 5.9 Soils 59
- 5.10 Visual Aesthetics 60
  - 5.10.1 Drilling Program Impacts 60
  - 5.10.2 Underground Exploration/Facilities Impacts 61
- 5.11 Cultural and Historic Resources 63
- 5.12 Socioeconomics 63
  - 5.12.1 Impacts Resulting From Drilling Activities 63
  - 5.12.2 Impacts Resulting From Underground Exploration 64

TABLE OF CONTENTS (Continued)

Page

6.0 CONSULTATION, COORDINATION, AND DISTRIBUTION OF THE EA 66

7.0 LIST OF PRINCIPAL PREPARERS 68

8.0 REFERENCES 71

LIST OF TABLES

Table 1 Cumulative Surface Disturbance on Unpatented Lamefoot Claims Through 1991
Table 2 Required Permits for Lamefoot Project
Table 3 Anticipated Surface Disturbance on Unpatented Lamefoot Claims During 1992
Table 4 Anticipated Surface Disturbance on Private Fee Land During 1992
Table 5 Equipment Requirements for the 1992 Drilling Project
Table 6 Cumulative Lamefoot Project Disturbance Proposed Through 1992
Table 7 Soil Suitability Characteristics
Table 8 Visibility of Lamefoot Project Areas From Local Travel Routes, Recreation Areas, and Residential Areas
Table 9 Ferry County Resident Labor Force and Employment By Labor Area
Table 10 Ferry County and Republic Population: 1980-1990

LIST OF FIGURES

Figure 1 General Location, Access, and Topography Map of Lamefoot Study Area
Figure 2 Land Status in Lamefoot Study Area
Figure 3 Cumulative Disturbance Map for Patented/Unpatented Lamefoot Claims
Figure 4 Wetlands Map
Figure 5 Soils Map
Figure 6 Approximate Topographic Visibility of Lamefoot Study Area Relative to Local Viewpoints

LIST OF APPENDICES

Appendix A Analytical Results From Groundwater Wells LF-1 and LF-2
Appendix B Wildlife Information From the Washington Natural Heritage Program
Appendix C Lamefoot Project Cultural Resources Report
Appendix D Reclamation Plan For the Lamefoot Project

Section 1

1.0 INTRODUCTION

This Environmental Assessment (EA) describes the drilling and underground exploration proposed by Echo Bay Minerals (Echo Bay) on the Lamefoot property. It's primary purpose is to evaluate the environmental consequences (impacts) of this project and describe appropriate mitigation to minimize potential adverse impacts.

Briefly, the proposed action includes an exploration drilling program on Bureau of Land Management (BLM) administered lands in Ferry County, Washington, as well as additional underground exploration activities to be conducted on adjacent private lands. The underground activities will be accessed through a portal constructed on private lands and a decline which crosses Federal lands. Although the exploration activities on private lands are not directly under BLM jurisdiction, information regarding these is included in this EA to provide an overview of proposed Lamefoot activities.

1.1 Purpose of and Need for the Proposed Action

A Plan of Operations for the Lamefoot Project proposed drilling program (Golder Associates 1992) has been submitted to the Spokane District of the BLM pursuant to 43 CFR 3809 and 36 CFR Part 228 Subpart A. The clearly defined purpose of the proposed action, as described in the Plan of Operations is to provide the additional information needed to assess and expand known Lamefoot mineralization on 50- and 100-foot drill centers. The information obtained from the drilling program will be integrated with the existing drill hole database, and used for economic feasibility analyses. In addition to the drilling program, an exploration portal will be constructed at a specific location within the private ownership portions of the Lamefoot area. Results from this underground exploration work will also be an important part of the feasibility analysis.

If the results of the exploration program are favorable, the project may be expanded into a commercial mining operation in 1993 or 1994. A separate National Environmental Policy Act (NEPA) document would be prepared for any future, larger scale mining projects, if necessary.

Most of the lands (approximately 80 percent) to be affected by the proposed Lamefoot Project exploration activities occur on private lands owned or controlled by Echo Bay. The remainder of the area to be affected consists of unpatented mining claims on public lands administered by the BLM. United States mining laws, and the regulations by which they are enforced, recognize the statutory right of mining claim holders to develop Federal mineral resources, as long as undue environmental degradation is not incurred. Further, such development is encouraged and is consistent with the Mining and Mineral Policy Act of 1970 and the Federal Land Policy and Management Act of 1976. These regulations require the responsible Federal agencies to review the Applicant's POO to ensure that:

- Adequate provisions are included to minimize, where feasible, adverse environmental impacts to surface resources on public lands;
- Measures are included to provide for reclamation, where practicable; and
- The proposed operations will comply with other applicable Federal and State laws and regulations.

Relative to the need for the proposed project, it should also be mentioned that exploration and eventual development of the Lamefoot Project is being pursued to supplement the ore production from other Kettle River mines. This supplemental production will be necessary to continue to operate the existing Key Mill at capacity, and to continue to employ the entire work force. The exploration activities will result in the maintenance of current Echo Bay employment at existing levels.

1.2 Background on Lamefoot Exploration and Drilling Program

Echo Bay controls numerous unpatented and fee lands in the Lamefoot vicinity as well as mineral leases on state land. Exploration activities on private lands in the Lamefoot vicinity have been ongoing for several years and have primarily involved the construction of drill roads and drill pads. These activities also have included the recent installation of two shallow monitor wells that are being used to establish baseline groundwater conditions at the Lamefoot site. In addition, a core shed on the private segment of the Lamefoot property is used to store all core samples and miscellaneous supplies for the overall exploration program. A water supply well located near the core shed supplies water for all of the drilling operations, both on the private and public lands in the study area. Echo Bay exploration-associated disturbance on private lands in this area totalled about 5.0 acres through the end of 1991.

The first Notice of Operations for exploration of unpatented claims on public lands administered by the BLM was submitted in September of 1989. Since then, Echo Bay has submitted Notices of Operations on a yearly basis, and when warranted, has amended these even more frequently. In addition to the disturbances related to drilling and the associated roads, activities on BLM land have included the construction of a landing (staging) area for equipment storage, supply delivery, sample loading and shipping and emergency medical evacuation. This area is located on Lamefoot (LF) claim 9.

As long as the cumulative disturbance area for all exploration activities on public lands remained less than five acres, BLM review of the previously mentioned Notices of Operation was all that was required for the legal continuation of the exploration activities. Table 1 provides a summary of surface disturbance associated with Echo Bay's Lamefoot exploration program on BLM lands through 1991. The table indicates that cumulative disturbance now totals 4.44 acres. Echo Bay's exploration planning indicates that the disturbance would surpass the 5-acre limit sometime in the upcoming year. Thus, the BLM requires more extensive documentation than that which was provided in the form of the previously submitted Plan of Operations. The need for NEPA

compliance is also triggered at this 5-acre disturbance area threshold; preparation of this EA is intended to meet this requirement.

1.3 Other Required Permits

In addition to receiving BLM approval for the Plan of Operations, Echo Bay will comply with other federal, state, and county requirements. Because the scope of the proposed drilling and underground program is limited, few additional permits and approvals will be required. The Ferry County Planning Department will, however, be notified of the scope of the drilling and underground exploration program in compliance with the Ferry County Mining Ordinance (RCW 36.32.120). The permits listed in Table 2 are required for the proposed operations.

1.4 Project Overview

1.4.1 Project Location and Access

The Lamefoot Study Area is located along the western flank of the Kettle River mountain range of northeastern Washington State in north central Ferry County. The area is approximately 120 miles northwest of Spokane, Washington, seven miles northeast of Republic, and 20 miles south of Curlew, Washington (Figure 1). The project site is accessed from State Highway 21 which runs in a north/south orientation between Republic and Curlew. Access through the Lamefoot area from State Highway 21 is via a county road known locally as the Wolf Camp Road (also sometimes referred to as "Wolfe"). Figure 1 shows the general topography of the Lamefoot vicinity as well as identifying site location and access. The Lamefoot Study Area delineated on Figure 1 includes portions of Sections 4 and 9, T37N, R33E and a small part of Section 33, T38N, R33E.

1.4.2 Project Area

Echo Bay controls mineral rights on more than 1,000 acres in the Lamefoot vicinity. The main portion of this area (about 680 acres) has been included in the Lamefoot Study Area shown on Figure 1. This fairly large study area has been delineated for purposes of study and analysis, even though only a very small fraction of the area will be involved in the proposed exploration drilling program. Ownership within the study area is a mosaic of public and private lands and includes unpatented mining claims on BLM land, private land owned by Echo Bay, and lands leased to Echo Bay by private entities and by the state. Figure 2 depicts ownership and claim block boundaries within the study area.

1.4.3 Summary of Project Activities

Echo Bay's proposed Lamefoot drilling program will involve drilling about 50 holes, as well as the associated road construction required to reach some of the drill sites. The drill holes include both reverse circulation rotary drill holes and coreholes. Table 3 and Figure 3 together provide a thorough summary of the proposed drilling exploration activities on BLM-administered lands. As indicated on Table 3, four general surface disturbance areas will be affected. Together, these four areas will represent 2.42 acres of new surface disturbance. Figure 3 delineates the proposed disturbance areas on BLM-administered lands as well as the cumulative exploration disturbances on BLM lands from previous years. For a complete discussion of the proposed activities see Section 2.

It should be noted that the location of disturbances on the west side of Wolf Camp Road as shown on Figure 3 are representative of Echo Bay's planned work, but that actual drill site locations may differ somewhat (up to 100 feet) from the site locations shown on the map. This is unavoidable because the specific orientation and location of the mineralization is currently unknown in this area. Thus, drill site locations may have to be adjusted as new information is gained during the exploration program.

In general, drilling will include the use of both truck- and skid-mounted core rigs as well as truck- and track-mounted rotary rigs. As many as four drills may be running at any one time during the 1992 year. Drilling will be on either 50- or 100-foot centers, depending on the location and level of mineralization delineation required.

When new road construction is required, a D-8 bulldozer or equivalent equipment will be used. It is not anticipated that any blasting will be required for the proposed drill roads and no blasting materials will therefore be used or stored on BLM lands.

Ancillary and support services required for the proposed drilling program will be minimal. The previously constructed landing (staging) area located on LF claim 9 (Figure 3) will continue to be used. If additional electrical power is needed for any reason, portable electrical generators would be brought in to meet short-term needs.

In addition to the drilling activities described above, an underground exploration program will be conducted on private lands. The underground activities will be accessed through a portal constructed on private lands with a decline which crosses Federal lands. Surface facilities associated with the underground activities will also be constructed on private lands. These activities are described in Section 2.3.

1.5 Project Schedule

The proposed drilling program will begin with road construction as soon as possible and will extend through the remainder of the year. Each reverse circulation rotary drill hole will take from one to three days to drill. Each corehole will take up to one week to complete. The drilling project will involve rotary drill rigs and core rigs. Drilling contractors will probably work a 10-day-on, 4-day-off schedule and will probably work at least one 10-hour shift each working day.

Portal #1 construction associated with underground exploration on private land is scheduled to begin in June of 1992 and will take about six weeks. Actual underground exploration activities will continue for 14 to 18 months following portal construction. Construction and exploration crews will work two 10 to 12-hour shifts per day, seven days per week. Site construction for surface facilities on private lands in and around the portal, begun in early May, 1992, will continue for about two months.

Section 2

2.0 DETAILED DESCRIPTION OF THE PROPOSED ACTION

This chapter describes the various exploration drilling activities proposed on unpatented claims which constitute the BLM's jurisdictional purview for this EA, as well as associated underground exploration work to be carried out on adjacent private lands concurrently with the proposed drilling. Over the next two to three years, exploration activities within the Lamefoot Study Area (Figure 1) will include the ongoing drilling program and underground exploration. At some point during the period, a decision will be made as to whether an economic ore body exists at Lamefoot. Additional appropriate NEPA environmental documents would be prepared at the time of a production decision, if warranted based on activities not covered under this Environmental Assessment.

2.1 Drilling Operations

The Lamefoot Area has been explored for a number of years. Echo Bay has drilled approximately 275 holes within the Lamefoot Area since 1989. The first Notice of Operations for exploration of unpatented claims on public lands administered by the BLM was submitted in September of 1989.

The proposed program for the Lamefoot Project will involve drilling at least 50 new holes in the Lamefoot area on public and private land. The information obtained from this drilling program will form a database on 50- and 100-foot centers, which will be integrated into the drillhole database generated by the existing 275 holes (as of the end of 1991) within the Lamefoot Study Area. This additional information from the new drillholes is necessary to make detailed and accurate reserve calculations, to assess the feasibility of mine plans, and to secure financial support for a potential full-scale development phase of the project.

Approximately 60 percent of the new holes to be drilled at Lamefoot will be 6-inch diameter reverse circulation rotary holes. The remaining holes will be 3- or 4-inch diameter coreholes.

The depth of both the rotary and coreholes will range between 250 and 1,000 feet. As noted in the summary of project activities (Section 1.4.3), the drillhole locations shown on Figure 3 are within 100 feet of their actual on-the-ground location. Each drill site will be flagged prior to drilling.

Water will be supplied by 2,000-gallon water trucks and distributed as necessary. Sumps will be necessary at some of the drill sites in order to collect drilling fluids and minimize overflow onto the surrounding landscapes. The sumps will have a sloped ramp so that animals can climb out should they venture into the sump. After drilling is completed at each site, the drilling fluids will be allowed to evaporate and infiltrate and the sump will be backfilled as soon as possible after drilling.

Drilling will include the use of both truck- and skid-mounted core rigs as well as truck- and track-mounted rotary rigs. As shown on Figure 3 and described in Table 3, drilling will occur in several areas and may result in as many as four drills running at any one time. New drill site disturbance will be minimized to the greatest extent possible utilizing the various impact-limiting features outlined later in this EA. These include limiting surface disturbance drill pad size to 30 feet by 30 feet, locating drill sites on roads or in natural clearings wherever possible, and drilling multiple holes from each pad, where feasible.

Road construction and reclamation on LF claims 15, 17, 19 and 20 was determined to be difficult. Exploration on these areas will occur through helicopter transport of drill rigs or through hand-pulling of the rigs to the drill sites. Drill pads for these areas will be 20 feet by 20 feet unless additional cleared area is absolutely necessary in order to ensure the safety of helicopter loading/unloading. The maximum area that would be cleared at any of the helicopter sites would be 50 feet by 50 feet.

None of the existing drill pads nor the proposed pads will be contiguous, and all drill pads will be separated from each other by zones of undisturbed vegetation.

2.2 Drill Roads

The proposed drilling program will result in the construction of approximately 2,520 linear feet of new roads and trails. Approximately 6,715 linear feet of roads and trails have been constructed to date on the unpatented (private) Lamefoot claims. Thus, assuming the anticipated footage of road construction is required, cumulative drill road footage would be about 9,235 linear feet. However, it may be possible to further reduce the linear feet of actual road constructed through the use of the impact-limiting features discussed in Chapter 4. Towards this end, existing trails and clearings will be preferentially used for providing access to drill pad sites, with little or no new construction requiring heavy equipment. In areas requiring heavy equipment, a D-8, D-7 or equivalent bulldozer will be used.

Road and trail widths may vary somewhat, depending on the intended use of the road as well as the terrain (that is, a road built in relatively steep terrain will result in more disturbance than one built on the flat). In general road widths will range from 20 to 30 feet. Water bars and safety berms/ditches will be installed to disperse runoff water along constructed roads.

2.3 Underground Exploration (on Private Lands)

In addition to the proposed drilling program, one exploration portal will be constructed on private land. Underground exploration activities will be conducted from the portal for a period of up to eighteen months, using conventional underground drill and blast exploration techniques. Exploration techniques will be similar to the underground mining techniques currently in use at Echo Bay's Kettle River Project and described in the Kettle River Project EIS (DOE 1988). At completion, the portal opening will be approximately 15 feet by 16 feet in size.

Underground access will consist of an exploration adit 15 feet x 16 feet in size 1,900 feet long. Additionally, three 15 feet x 12 feet levels totaling 3,400 feet will explore the mineralization.

They will be connected by a ramp 2,200 feet long measuring 15 feet x 16 feet. Drilling will be conducted underground from all of these workings.

Most of the development levels are designed to be driven in ore. If ore is encountered where expected, about 60,000 tons will be excavated. Additionally, about 75,000 tons of waste will be generated. The ore will be temporarily stockpiled near the portal and hauled about 8 miles to the Key Mill by the same route currently used for hauling from the Kettle Mine west of Curlew. This would require about 15 to 20 round trips per day for about 4 months. Ultimately if full scale production occurs, up to 50 trips per day could occur if reserves and mill capacity warrant.

An underground drift at about the 2,605 foot level elevation will transect BLM-administered property in LF claims 17 and 15 (see Figure 3). The purpose of and need for this drift is purely for access to known mineralization on adjacent fee lands. Geologic exploration in the vicinity of this access show that competent rock exists above the drift and subsidence is not expected to occur on public lands as a result of the underground drift.

The portal will be constructed such that no widening or additional construction will be necessary if a decision is made to go into production. Blasting materials will be stored on-site in a strictly controlled explosives magazine, subject to and in compliance with MSHA regulations. There will be no use nor storage of explosives on BLM lands. Upon completion of underground exploration and/or commercial mining, whichever occurs last, the underground portals will be sealed in accordance with all applicable regulations.

A site plan locating the portal and associated surface facilities is shown on Figure 3. Table 4 summarizes the proposed disturbance associated with underground exploration. Exploration Portal #1 and associated surface facilities are located in Section 9, T37N, R33E. The affected surface area will be about 15.1 acres. Surface facilities associated with Portal #1 will include a shop, parking lot, core shed, substation, pumphouse, staging area, topsoil stockpile, ore

stockpile, settling pond, waste rock dump, fuel storage container, explosives magazine, and drain field. The portal and shop areas will be fenced, limiting access to and from the site. Entrance to the project area will be via Wolf Camp Road which intersects State Highway 21 about seven miles northeast of Republic. Figure 3 identifies specific site access and shows the general topography of the site.

Wolf Camp Road is presently maintained as a county road by Ferry County. Echo Bay, in cooperation with county officials, is proposing a road diversion approximately 925 feet north of the existing intersection of Wolf Camp Road and State Route 21. The proposed road diversion will route public traffic around the project site. Mine traffic associated with the site will exclusively utilize the existing section of Wolf Camp Road south of the proposed diversion road but this road would now be considered a private road. As a result, mine traffic on public roadways will be greatly reduced. The diversion road (shown on Figure 3) currently parallels a section of one of the wetland areas just north of the project site (refer to Section 4.6 of this report as well as Figure 4 for location and description of the wetland areas). At present, a 50 plus foot vegetated buffer zone is planned to separate the existing wetland and the proposed road diversion. Safety considerations, engineering design parameters, and environmental considerations will be weighed prior to final Ferry County approval of the road diversion.

2.4 Equipment Requirements

The drilling/road building and portal/site construction equipment needed for the proposed exploration program is listed in Table 5. As presently planned, all of this equipment will be operated by qualified personnel or provided by and operated by a qualified contractors. If necessary, this equipment list may be revised during the life of the project to suit actual conditions and equipment availability. In addition to the equipment listed in Table 5, several four-wheel drive pickup trucks or other light vehicles will be on site most of the time. As noted in Table 5, the equipment required exclusively for underground exploration will not be used in

drilling and will be restricted to those portions of the Lamefoot Study Area described in Section 2.3.

2.5 Fire Fighting Equipment

All light vehicles used on site will be equipped with an ax, shovel, bucket, and fire extinguisher. In addition, all vehicles will have adequate spark arrestors. A telephone is available at the core shed, which is located on the private land within the study area and is within one mile of all the proposed drill sites. Echo Bay will promptly comply with any emergency directives by the BLM and the Washington State Department of Natural Resources will obey any fire precautions imposed on operations during the summer fire season. During periods of high fire danger as designated by the BLM, the water trucks servicing each drill rig will have pumping capabilities and a minimum of 100 feet of hose. In the event of a fire on the project site, all fire control direction will be handled by the State in accordance with existing agreements.

2.6 Work Force and Schedule

The proposed drilling program is expected to employ about 18 people, some of whom will be Echo Bay employees. The drilling program is expected to employ four Echo Bay geologists, eight drillers (2 per drill rig), four samplers (1 per drill rig), 1 driver for sample hauling, and 1 cat skinner.

Drilling and sampling will be performed in work periods probably consisting of 10 consecutive days, 10 hours per day. Each work period will be followed by four days off.

Underground exploration on private lands will employ approximately 30 people, all of whom will be Echo Bay employees drawn from the Kettle River Project workforce. The timing of Lamefoot exploration is planned such that as production (and therefore, the workforce requirement) diminishes at the Kettle River Mine, employees can be transferred to Lamefoot to

participate in underground exploration work. This will prevent layoffs at a critical time. Portal construction and underground exploration will be performed in two 10- to 12-hour shifts per day on a seven day per week schedule. As previously noted, portal construction will take about six weeks, and will be followed by the actual underground exploration over a period of 14 to 18 months.

Site construction of the surface facilities shown on Figure 3 will be performed mostly by contractors. The number of individuals employed on-site for the construction period would be at the contractor's discretion, but would probably not exceed 15 laborers. The contract would not specify daily work hours or schedules.

2.7 Office Space and Ancillary Facilities

The main office facility for the project is located at 921 Fish Hatchery Road near Republic. No new surface facilities are proposed on BLM-administered lands. As previously discussed, the already constructed landing area (about 1/2 acre) in LF claim 9 will continue to provide the primary area for drill sample loading, supply receiving, parking, and equipment and drilling supply storage for exploration work on the public lands portion of the Lamefoot Study Area. In the event of an emergency, medical or otherwise, the landing could also be used by helicopters.

Surface ancillary facilities for portal construction and underground exploration have been previously discussed in Section 2.3 and are shown on Figure 3. To briefly reiterate, on-site activities for Portal #1 will include a core shed, substation, pumphouse, parking lot, drain field (septic system) shop, fuel storage container, lay down area, settling pond, compressor, waste dump for rock removed from the portal and from underground blasting, ore stockpile, and a topsoil stockpile that will also double as a berm providing visual screening of the site from State Highway 21. These facilities are, as shown on Figure 3, located at the lower (southern) end of Wolf Camp Road as it currently exists.

2.8 Cumulative Project Disturbances Proposed Through 1992

The cumulative project disturbance proposed through 1992 includes the cumulative drilling disturbances on private and public lands as well as the disturbance that will be associated with underground exploration on the adjacent private property (patented claims). Table 6 enumerates all existing and proposed disturbances associated with Lamefoot Project exploration. Disturbances on BLM land will total 6.86 acres by the end of the proposed project (4.44 acres through 1991, see Table 1; and 2.42 acres in the proposed project, see Table 3). Disturbances on private lands will total 20.6 acres by the end of the proposed project (5.0 acres of drilling disturbances through 1991; and 15.6 acres in the proposed project). The cumulative project disturbance will total 27.46 acres by the end of the proposed project.

Future exploration-associated disturbances are difficult to predict because the need for additional exploration will be based on the results of the proposed program. However, it is anticipated that two helicopter landing pads will be constructed on the State EBM Lease shown on Figure 2. This area is included in the overall Lamefoot Project Study Area delineated in Figure 1. The landing pads will be necessary to conduct exploratory drilling on the state lease land.

According to information received by Echo Bay, exploration drilling was performed in 1991 on property to the west controlled by Park Lane/Equinox. Inland, N.A. Degerstrom and Echo Bay have explored areas east and south of the Lamefoot Area on private lands. However, at this time, Echo Bay is not aware of any imminent mining proposals that would increase the cumulative surface disturbance in the Lamefoot vicinity.

Reasonably foreseeable actions or decisions that may occur as a result of the Lamefoot exploration program are addressed below.

- If mineral deposits are such that they are economically infeasible to mine, future work will be canceled and the area reclaimed shortly after project completion.

- If mineral deposits are such that further information is required, exploration will continue until either a production decision is made or future work is canceled.

- If mineral deposits are such that a production decision is made, the Key Mill will be utilized for ore processing. Currently, the Overlook, Kettle and Key Project ore is expected to fill the existing tailings facility. However, disposal of tailings from the Lamefoot ore processing can occur simultaneously with Overlook, Kettle and Key tailings until the existing facility reaches capacity and an expansion has been designed and permitted. Permits associated with the facility expansion and any associated with additional surface disturbance on public lands would be addressed at that time.

Section 3

3.0 DESCRIPTIONS OF ALTERNATIVES CONSIDERED

The alternatives initially considered, other than the proposed action described in the preceding chapter, include the No Action alternative and reasonable alternatives regarding drilling methods, drill road locations, portal locations and reclamation methods. Alternatives regarding other substantive changes in the proposed action were not feasible given the very limited scope of the project (i.e. total cumulative disturbance of approximately 6.86 acres on public lands and 27.46 acres total).

The primary alternative considered in this EA is the evaluation of a second portal (Portal #2) for access to the mineralized zone instead of or in addition to Portal #1.

Exploration Portal #2 and associated facilities are located in Section 4, Township 37 North, Range 33 East. If constructed the affected surface area would be limited to about 7.2 acres and is located approximately three-quarters of a mile northeast of Portal #1 along Wolf Camp Road (see Figure 3). Surface facilities will include a waste rock dump, ore stockpile, settling pond, surge tank, water line, compressor and transformer or generator. Portal #2 and associated facilities will affect approximately 7.2 acres of private land.

The portal will be constructed in a manner similar to Portal #1. The portal will be 15 feet x 16 feet in size, large enough for production should exploration results warrant full scale development.

The only other alternative actually carried through impact analysis was the No Action Alternative as described below because other alternatives initially considered were deemed by the BLM to be too environmentally destructive to warrant detailed consideration. NEPA does not require that alternatives eliminated early in the EA process because of serious flaws be carried forward into the impact analysis. The following project changes were made during the review process and the original alternatives were dismissed for further evaluation in the EA:

- The initial plan included road construction for all drilling sites. The use of helicopter or hand pulling rigs to drill sites on LF claims 15, 17, 19 and 20 will reduce the disturbance on BLM lands by approximately 50 percent (%) and will allow for a more effective reclamation of disturbance. An alternative for road construction in these areas was dismissed.

- The grid-like arrangement of the drill holes originally proposed for LF claims 3, 5, 7, and 9 has been modified to utilize existing clearings, thus reducing the area of new disturbance. The grid-like arrangement is not considered as an alternative for evaluation in this EA.

- A proposed drill road immediately west of Wolf Camp Road in claims LF 3 and 5 has been eliminated because it would impinge on wetland areas. An alternative including this road is not a part of the EA.

- Maximum drill pad size has been reduced from 50 feet by 50 feet to 30 feet by 30 feet, except where helicopter-supported drills are necessary. The larger drill pads are not considered in this EA.

- Existing trails and clearings will be preferentially used for providing access to drill pad sites. New roads will be created only after using existing roads to the maximum extent possible. The proposed alternative includes the minimal road construction possible for this project and additional road construction was not considered.

- Drill sites have been located on roads to the extent possible. Alternatives which require additional construction for off-road drill sites for those areas which contain on-road drill sites was not considered a feasible, environmentally protective alternative and were not further evaluated.

No Action Alternative

The No Action Alternative is included in this discussion, as required by NEPA. The No Action Alternative would constitute maintenance of the *status quo*, meaning that the BLM would not approve the POO. However, the General Mining Law of 1872 gives Echo Bay the right to pursue a mining operation on federally managed lands as long as it does not cause undue or unnecessary degradation of the federal lands (43 CFR 3809.0-6).

The No Action Alternative does provide a basis from which to measure the impacts of the proposed alternative. Most of the project-specific impacts (environmental consequences) discussed in Chapter 5 of this EA would not occur under the No Action Alternative, but because some of the area is already disturbed by exploration activity, the area of the proposed project would ultimately bear some scars even if no further exploration were to occur.

Selection of the No Action Alternative would eliminate from consideration the recovery of the gold mineral resources planned by the project sponsor. The resource would thus remain in place as a potentially recoverable deposit (see Section 4.2, Geology).

Section 4

4.0 AFFECTED ENVIRONMENT

4.1 The Environmental Setting and Site Investigations

The physical, biological, and human resources of the Lamefoot Project Study Area and its surrounding environs are described in this chapter. This information forms a basis against which the effects of the project may be measured in the Chapter 5 impact analysis. Each resource is described in this chapter at a level of detail commensurate with the level of potential adverse impacts that could occur as a result of project implementation. The initial discussion on environmental setting presented in this section provides a backdrop for the more detailed resource descriptions that follow.

The project area (Figure 1) is within the Okanagan Highland physiographic province in northeastern Washington State. This region encompasses the mountainous area between the Selkirk and Okanagan Rivers. Physiography might be defined as a way of describing and classifying topography and vegetation in terms of the geological processes that have created them. The Okanagan Highlands province is characterized by moderate slopes and broad, rounded summits created by repeated continental glaciation during the Pleistocene Epoch. Elevations are lower, and terrain more moderate relative to areas which were not subjected to continental glaciation, the North Cascades being the nearest example. Glacial features such as terraces, moraines, and valley trans are numerous. Mountain tops are generally forested with a mixture of Douglas fir, ponderosa pine, western larch, and other coniferous trees. South-facing slopes and valleys are grassed, being generally too dry for trees. Soils are generally quite fertile. Common wildlife species include bear, mule deer, white-tailed deer, and various other game and nongame species (Franklin and Dyrness 1973; Fenneman 1931).

Elevations in the study area range from approximately 2,500 to 3,300 feet above mean sea level (msl). The study area is influenced by elements of both maritime and continental climates because air masses from the Pacific and the continent cross the region. The study area and

vicinity is in the rain shadow of the North Cascades, and is consequently drier than areas further east. In general, the area has warm summers and cold winters with a mean maximum July temperature of about 84 degrees F and a minimum January temperature of about 16 degrees F. Annual precipitation at lower elevations ranges from 15 to 20 inches, about half of which occurs from October through January as snow.

The study area is remote by many people's standards. The nearest city of any size is Spokane, with the smaller towns of Republic and Curlew located near the project area. The study area is serviced by a combination of state and county roads. The economy of Ferry County, in which the study area is located, is strongly resource-based, primarily in agriculture, timber, and mining. While the government and services sectors are becoming increasingly important, resource-based activities generate the most income. Land uses in the study area and vicinity reflect this economy; logging, ranching, and mining are historically and presently dominant. Recreation, chiefly of a dispersed nature, is also an important land use. Much of the region consists of public lands administered by the BLM or the Forest Service. These public lands provide opportunities for a variety of recreation activities. The aesthetic resources of the region can best be described as pastoral, not as spectacular as the North Cascades but nonetheless of moderate quality, and appearing basically natural rather than disturbed.

Though the techniques used to assess the various resources described here vary somewhat, all assessments had several things in common. Each assessment involved on-site investigations, both within the study area and in any other areas of concern to a particular resource. Field assessments were conducted chiefly in the summer of 1991, though some work was carried out throughout the year. Resource tasks leaders responsible for these assessments and subsequent report preparation are all experienced in performance of environmental studies and preparation of baseline reports and environmental assessments and impact statements. All task leaders are specifically experienced with regard to mining projects in the western United States, including several precious metals projects in northeastern Washington and Montana. The various task leaders are identified and their qualifications summarized in Chapter 7.0.

4.2 Geology

The regional geology of the area is discussed by Muessig (1967). However, nothing has been published regarding the site-specific geology of the Lamefoot Project Study Area. Nevertheless, the area has been extensively studied by Echo Bay.,

The rocks of the area consist of weakly metamorphosed sedimentary and volcanic rocks of Permian (?) age. A grey micritic limestone and a sequence of poorly bedded greywackes are the dominant lithologies in the areas. These are intruded by the Tertiary age Scatter Creek Rhyodacite.

Metasedimentary lithologies are moderately to steeply dipping and strike in a north-northeasterly direction. The dominant fault and fracture pattern is also in a north-northeasterly trend parallelling the structural trend of the regional Republic Graben. This fractures pattern would be expected to be the primary control on groundwater movement in the area.

Mineralization at the Lamefoot Project consists of two ore types forming a steeply dipping lenticular body parallel to the structural grain of the area. Massive ore consists of magnetite with lesser amounts of pyrite and pyrrhotite. "Clastic ores" are composed of siliceous veins and replacements of greywacke containing both vein controlled and disseminated iron sulfides.

Reserves are currently reported at 917,000 tons with an additional two million tons of additional mineralized material defined by widely spaced drilling. The ore zone is about 1,500 feet long and 15 to 150 feet in width. Additional exploration is needed to determine the extent of proven and probable reserves as well as to establish continuity of grade and geometry of the existing reserves.

4.3 Hydrology: Surface and Groundwater Resources

4.3.1 Surface Water

No perennial streams have been identified within the Lamefoot Study Area. A spring from perched fractured groundwater is located on the private ownership portion of the study area adjacent to Wolf Camp Road and about 600 feet north of the core shed identified on Figure 3. The spring location is shown on the wetlands map, Figure 4. A very small drainage flows from the spring downslope about 750 feet into a wet area, mapped as a wetland in the preliminary wetlands determination conducted in October 1991 (see Section 4.6). The wetland area does not have an outlet (i.e., water flowing into the wetland area from the spring percolates back into the groundwater and/or evaporates/transpirates at this site).

4.3.2 Groundwater

According to exploration drilling records, groundwater has been intercepted at several locations within the study area. The study area has two basic types of groundwater occurrence. Groundwater occurs within the unconsolidated glacial deposits at lower elevations and in the valley bottom. The upper groundwater occurrence is localized along the gravel/bedrock interface and moves downgradient in response to topography of the bedrock surface. Within bedrock groundwater is locally contained within fractures in the bedrock.

In order to more accurately define baseline groundwater conditions, Echo Bay authorized the installation of two new monitor wells in October of 1991. The water quality monitoring wells were installed to intercept groundwater in the unconsolidated glacial deposits. As these glacial deposits are relatively homogeneous in permeability, the gradient and source are the primary factors in controlling groundwater occurrence. The two wells are located adjacent to Wolf Camp Road in the private ownership portion of the Lamefoot Study Area. Monitor well locations are shown on Figure 3. Water level readings were obtained from the newly installed

wells prior to well development and at the conclusion of field activities. Prior to well development, water levels at the two wells (LF-1 and LF-2) were recorded at approximately 8.4 feet and 18.9 feet below ground service (bgs), respectively. At the completion of field activities, water levels at LF-1 and LF-2 were recorded at 8.5 feet and 19.6 feet bgs, respectively. The groundwater samples initially collected at the newly installed wells were analyzed for general water characteristics, trace metals, major cations and anions, minon ions, and nutrients. The analytical laboratory reports are presented in Appendix A. The results reveal elevated levels of sulfate. The remaining results indicate either very low concentrations or concentrations below detection limits. The new monitor wells will be sampled monthly until a baseline is established.

In addition to the wells installed by Echo Bay, a private well exists on lands adjacent to the proposed project to the west. This well is on the Heckly property and is used for domestic purposes. Depth of the well and the zone used for water withdrawal are not known.

Groundwater occurrence in the underlying bedrock is controlled by the presence of interconnecting fractures. The bedrock in the study area is comprised of greenschist facies metagreywackes, micritic limestones, and fine-grained porphyritic rhyodacite. All of these rock types are relatively impermeable but contain fractures resulting from various episodes of tectonic activity. Exploration drilling has encountered small quantities of groundwater in the bedrock throughout the study area. However, the exploration coreholes were drilled by pumping water into the drillholes, therefore there is no quantifiable data regarding location and amount of groundwater. Most of the groundwater encountered during exploration is interpreted to be locally perched water contained within the fractures.

Significant quantities of groundwater within the bedrock are not anticipated to be encountered within the planned workings of the exploration program. However, any development of workings below the 2,600 ft elevation may encounter more significant bedrock groundwater inflow.

4.4 Air Quality

The air quality of the region surrounding and including the Lamefoot Project Study area is generally good. The Washington Department of Ecology (DOE) has classified the area as attainment for all criteria pollutants. Total suspended particulates (TSP) is the only pollutant the state monitors in the northern Washington Air Quality Control Region, which includes the study area. Other pollutants do not exist in sufficient quantities to warrant sampling by the state.

4.5 Noise

The sources of manmade noise currently affecting the Lamefoot Project Study Area include exploratory drilling operations, occasional aircraft overflights, and vehicular traffic. Natural sources of noise (i.e., those not associated with human activities) include wind, rain, thunder, insects, birds, and other wildlife. Available data indicate that noise levels in natural environments such as the study area may range from 15 decibels (dBa) up to 45 of 50 dBa, depending upon the naturally occurring noise sources. In order to give the reader a frame of reference for dBa measurements, it should be noted that a dBa rating of 25 to 30 is equivalent to a person whispering five feet away from a listener in a quite room, whereas 65 dBa is equivalent to the noise of a busy typing office or an urban downtown intersection. Heavy metal rock concerts are sometimes in the 120 to 130 dBa range. The EPA has established a standard to 70 dBa to protect public health and welfare with a margin of safety. If prolonged exposure to noise in excess of 70 dBa occurs, hearing loss is possible.

The Washington State noise standards are contained in Chapter 173-60 WAC. They are a bit complex, but the basic requirement for all the project facilities is 60 dBa for daytime hours, 50 dBa from 10 p.m. to 7 a.m., as measured at the property line. Increases of five, 10, and 15 dBa for 15, five, and 1.5 minutes respectively, are allowed during any hour of the day or night. Blasting is exempt entirely. Construction noise is exempt from 7 a.m. to 10 p.m. only. Motor

vehicles operated off public roads are not exempt. Motor vehicles on public roads are regulated separately.

4.6 Wildlife

4.6.1 Information Review

The existing wildlife resources of the Lamefoot site were evaluated on the basis of a review of existing information, including Washington Natural Heritage Database records of threatened, endangered, and special concern species and habitats in the state of Washington (Natural Heritage Data System, information dated March 4 and 31, 1992, Appendix B); a botanical survey of the study area (Mastrogiuseppe Environmental Consultants 1991); and a site visit on October 23, 1991. In terms of detecting wildlife species in the field, the results are limited because summer resident birds had already migrated from the area, bats had either migrated or entered hibernation, and reptiles and amphibians were dormant. Many other species, such as small mammals, are inconspicuous and would require much greater time and effort to detect than was available for this environmental analysis.

4.6.2 Habitat Overview

The study area is comprised of distinct habitats which occur in a mosaic dictated by topographic and drainage patterns. Upland conifer forests cover most of the site. These forests are dominated by Douglas fir, but include significant numbers of ponderosa pines. The understory in the forested areas varies from dense shrubs to scattered shrubs and herbaceous vegetation. Forest density ranges from closed canopy to open. Large old trees, snags, and plentiful down woody material are present and enhance wildlife habitat quality for diverse species such as nesting raptors, cavity-nesters, reptiles, bats, small mammals, and woodpeckers.

Openings of various sizes exist throughout the forested areas. Some openings support grassland habitats with only scattered shrubs. One large west-facing hillside east of Wolf Camp Road is shrubland with only a few scattered trees.

Patches of quaking aspen and cottonwood, with shrubs such as redosier dogwood, ninebark, and willow occur in moist sites. Dense grasses form the ground cover in the more open canopy sites. Wetland areas occur in a few places along drainages, on slopes, and in depressional areas. A map of wetland areas is included in the vegetation discussion (Section 4.6). These areas also include snags and abundant down woody material, thus providing habitat for cavity-users, woodpeckers, reptiles and amphibians, as well a many other species. Several small ponds with margins of short emergent vegetation exist along stream courses and in depressions. They are often surrounded by aspens and/or cottonwoods.

Cliffs, rock outcrops, and talus slopes exist in the study area on steep terrain. These provide potential habitat for roosting bats, cliff and outcrop users such as Townsend's solitaires, yellow-bellied marmots, wood rats, shrews, mice, voles, reptiles, and amphibians.

4.6.3 Wildlife Species Composition

The wildlife species observed during the field visit are typical of similar habitats in the region. Species or recognizable signs observed during the field visit included the following birds: an accipiter hawk (either a female Cooper's hawk or a male goshawk), American robin, black-billed magpie, Clark's nutcracker, common raven, evening grosbeak, golden-crowned kinglet, gray jay, hairy woodpecker, mountain chickadee, northern flicker, pileated woodpecker, pine siskin, red-breasted nuthatch, red-tailed hawk, and red crossbill. Mammals or recognizable signs included: coyote, deer (probably both mule deer and white-tailed deer but none were observed--tracks, well-used trails, and scat were commonly observed), pocket gopher, red squirrel, snowshoe hare, vole, and yellow-pine chipmunk. Droppings from a medium-sized carnivore, within the range of a small raccoon or fox, mink, marten, long-tailed weasel, or skunk were also

observed at several sites in the study area. At least 150 other wildlife species have been recorded from the region and the nearby Colville National Forest, and many of these species can be expected to occur at least occasionally in the study area.

This area appears to be heavily used by deer as is the case in much of Ferry County. Numerous heavily used trails and droppings ranging in age from very old to very recent were observed throughout the study area. The visible trails traversed slopes above and below Wolf Camp road. This area may be important year-round range for deer, given its relative abundance of forage in open areas and shrub understory areas, and adjacent closed forest providing thermal cover. It is identified as mule deer winter range by Washington Department of Wildlife (information dated March 31, 1992, Appendix B) see Figure 7. The site's relatively low elevation and aspect create snow-free areas where deer movements are not inhibited, browse and thermal cover is located in dense conifer stands within this area.

4.6.4 Rare, Threatened, or Endangered Species

The Washington Natural Heritage Data System (information dated March 4, 1992, Appendix B) has no records of any rare, threatened, endangered, or otherwise special-status species on the study area. There are, however, records from the general vicinity of two species of concern to the State of Washington. Neither of these records occur within the Lamefoot Study Area. There is a nest record for the red-necked grebe on Curlew Lake (Section 5), and a nest record for great blue heron near Curlew Lake (Section 8). The red-necked grebe and great blue heron are classified as State Monitor species, meaning that they are native to the State, and meet at least one of the following criteria: "1) they were at one time classified as endangered, threatened, or sensitive; 2) they require habitat that has limited availability during some portion of its life cycle; 3) they are indicators of environmental quality; 4) they require further field investigations to determine population status; 5) they have unresolved taxonomy which may bear upon their status classification; 6) they may be competing with and impacting other species of concern; or 7) they have significant popular appeal. State Monitor species will be managed by the

Washington Department of Wildlife (WDW) as needed, to prevent them from becoming endangered, threatened, or sensitive," (Washington Natural Heritage Program 1990).

Red-necked grebes nest over water, building nests on constructed mounds of vegetation in shallow water. There is no such aquatic habitat in the Lamefoot Study Area. Great blue herons nest colonially in large trees, building stick nests one foot or more in diameter. Forested slopes containing potentially suitable large conifers within the study area were examined through 10x binoculars from a variety of vantage points; no nests were observed.

Both the northern goshawk, which may have been observed (refer to discussion in Section 4.5.3) and the pileated woodpecker, which was observed on several occasions in the study area, are classified as State Monitor Species (WDW 1991).

4.7 Vegetation and Wetlands

4.7.1 Information Review

The existing vegetation and wetland resources of the Lamefoot Study Area were evaluated based on a review of existing information and a site visit on October 23, 1991. Reviewed information on the site included a botanical survey of the study area (Mastrogiuseppe Environmental Consultants 1991), National Wetlands Inventory map (U.S. Fish and Wildlife Service 1987), and the Soil Conservation Service (SCS) soil survey (SCS 1979).

4.7.2 Plant Communities

Topography of the Lamefoot site is dominated by steep slopes cut by deep ravines. Small areas have been disturbed by road cuts, mining exploration, gravel extraction, grazing, and an old clear cut. However, a large part of the area is relatively undisturbed and vegetation is in good condition.

Most of the area is forested, primarily by the Douglas fir/ninebark habitat type. Other scattered communities include ponderosa pine/Douglas fir forests, shrub/grass communities, aspen and/or cottonwood groves, and small wetland areas. These communities are described in detail in Mastrogiuseppe (1991) and summarized below.

The dominant plant community is a closed canopy Douglas fir/ninebark habitat type. Ponderosa pine and snowberry are scattered but common in this community. On drier sites, ponderosa pine and snowberry increase in importance, and the canopy is open.

Dry open areas are dominated by bunchgrasses including bluebunch wheatgrass and Idaho fescue. Moist openings have developed a Kentucky bluegrass community, and highly disturbed sites support predominantly cheatgrass. Upper ridges support the big sagebrush/bluebunch wheatgrass habitat type.

Moist swales support a community of quaking aspen and black cottonwood. Common understory shrubs include oceanspray, twinflower, Columbia clematis, and black hawthorn.

There are several small wetlands associated with the main north-south stream corridor adjacent to Wolf Camp Road. Quaking aspen, willow, and red-osier dogwood usually border these wetlands, with a variety of wetland grasses, sedges, and forbs comprising the understory.

4.7.3 Rare, Threatened, or Endangered Species

A botanical survey of the study area was conducted in July and September, 1991 (Mastrogiuseppe 1991), the primary goal of which was to search for any rare vascular plant species. Although no federally listed or candidate species are known to occur in Ferry County, several species of concern in the State of Washington are known to occur (Washington Natural Heritage Program 1990). None of these species of special concern were found on the Lamefoot site; however, one species not previously known to occur in Ferry County was located on the

site. This species is a many-headed sedge (*Carex sychonocephala*). One small population was found on the western edge of a small seasonal pond near the south end of the study area, a few yards north of the core shed on private land (Mastrogiuseppe 1991). This population has been impacted by grazing of domestic animals, both through consumption of the plants and trampling of the substrate. With the recent transfer of surface rights of this portion of the fee lands to Echo Bay no further grazing is planned for this area.

4.7.4 Wetlands

Wetlands are defined by the U.S. Army Corps of Engineers (COE) as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 323). Wetlands can provide essential habitats for wildlife, provide flood protection through absorption of storm water, improve water quality by retention of sediments and/or pollutants, and add scenic diversity and aesthetic value to the landscape. To curb loss of wetland acreage, federal and state legislation exists to preserve wetland values and functions. The COE has jurisdiction over the filling of wetlands through the Clean Water Act, while the U.S. Environmental Protection Agency (EPA) is responsible for reviewing all COE fill permit decisions. In the State of Washington, COE is the wetland regulatory agency, and the Washington Department of Ecology (WDOE) provides advisory input. Additionally, Ferry County has proposed management practices for wetlands in conjunction with implementation of the Growth Management Act of the State of Washington.

There are two areas in the Lamefoot Study Area that support wetlands (Figure 4). One is at the south end on the study area. There are two small ponds in a drainage north of the core shed, a small spring on the east side of Wolf Camp Road about 500 feet northeast of the core shed, and an aspen wetland south of the core shed. Water from the ponds and the spring feed into the aspen wetland. This area is on private lands and is not affected in any way by the proposed drilling program, but is in close proximity to proposed surface facilities adjacent to Portal #1.

Steps will be taken in the layout of the surface facilities to monitor and protect if necessary wetlands integrity. These are discussed in Section 5.0.

A second wetland area is east of the Heckly property. There are two seasonal ponds west of Wolf Camp Road in the bottom of a drainage swale. This area was originally the proposed location of a new drill road and drill pads for the drilling program. The modified program now proposed (Figure 3) avoids this wetland area.

4.7.5 Timber and Range Resource

In the past there has been some logging in the vicinity, but steep slopes and extremely erodible soils reduce the potential for timber harvest in the study area. There is also a limited amount of grazing, but this, too, is limited to the flat or more gently sloping parts of the site.

Approximately 50 acres of the private land within the study area has been selectively logged over the spring of 1992 by individuals not associated with Echo Bay operations.

4.8 Soils

4.8.1 Information Review

The primary source of published information available on the soils of the region is the North Ferry Area, Washington Soil Survey (SCS 1979). This report provides information about use, management, and limitations of the soils mapped. The survey was made cooperatively by the U.S. Department of Agriculture Soil Conservation (SCS), the USFS, and the Washington Agricultural Experiment Station. Most of the information provided in this report section was excerpted from the published soil survey. This information was augmented by a site visit on October 23, 1991.

4.8.2 Soil Types and Characteristics Affecting Rehabilitation

A total of 11 soil mapping units are represented within the Lamefoot Study Area. These mapping units are delineated on Figure 5 and defined in the legend of that figure. The 11 mapping units are comprised of seven soil series and a colluvial land unit. Detailed series descriptions are included in the SCS (1979) Soil Survey and are not repeated here.

Over half of the soils in the study area belong to the Molson series mapping units. These are generally loams, silt loams, and stony loams that are well drained and are not overly erosive unless slopes exceed 25 percent.

The suitability of soils for use as topsoil in reclamation is a major consideration in the evaluation and description of the study area soils resource. The North Ferry Area Soil Survey provides basic ratings for physical and chemical characteristics as well as some potential uses for each of the soil mapping units. Soils that may occur as small inclusions in a mapping unit are not represented in the suitability ratings of the soil survey reports. Table 7 provides a summary of the suitability information from the SCS survey. The last column of Table 7 is the overall SCS suitability ranking for topsoil.

As is evident from the table, many of the soils occurring within the project area are ranked as being poor sources of topsoil. Further examination indicates that the basis for the poor rankings is almost universally because of the relatively steep slopes on the site and, in some cases, because of stony and/or gravelly textures. Although these factors certainly affect the ease with which topsoil can be stripped, stockpiled, and redistributed, the technology does currently exist with which to accomplish these activities on steep, rocky slopes.

Successful mine reclamation has been accomplished in many mountainous (i.e., steep, rocky) areas using conventional machinery in sometimes unconventional ways. It should be noted here that the topsoil suitability rankings provided in the North Ferry Area Soil Survey were developed

in the mid 1960s. Reclamation research was, at that time, in its infancy and has progressed rapidly in the last two decades. Thus, although it is obvious from the soil descriptions provided in the preceding subsection and the information in Table 7 that soil in the study area would not be an ideal source of topsoil, it is important to look beyond the physical limitations just discussed to examine the chemical, textural, and quantitative characteristics of these soils.

In general, the soils within the study area are not greatly limiting in terms of their chemical and textural characteristics. For the most part, soil textures are loamy, albeit sometimes being stony, sandy, or gravelly loams. Coarse fragments larger than three inches in diameter do not exceed five percent in the surface layers and soil pH for all of the soils is in the acceptable range for plant growth. Likewise, permeability is generally acceptable and available water capacity is moderate. Seedling mortality and plant competition ratings are certainly acceptable on the basis of information presented in Table 7. Although depth to bedrock is quite shallow in some mapping units, it exceeds 60 inches in most.

The primary concern with regard to study area soils is their erosiveness and instability on areas with steep slopes. Since much of the area is quite steep, this is the overriding soils issue.

4.9 Visual Aesthetics

Aesthetic resources of the project area were evaluated during a site visit on October 22-24, 1991. Aesthetic resources were evaluation from four perspectives:

- Composition;
- Quality;
- Condition; and,
- Visibility.

4.9.1 Composition

While the concept of aesthetics is inherently subjective, the visual resource can nonetheless be systematically assessed. One such means of assessment is description of the composition of aesthetic resources; specifically in terms of four landscape elements:

- Form;
- Line;
- Color; and,
- Texture.

The visual effect of a landscape is produced by the interaction of these elements. Geologic features, water bodies, soils, and vegetation are the "raw materials" which produce the combination of landscape elements that is unique to each landscape. Description of aesthetic resources in terms of composition is particularly useful relative to impact assessment and mitigation. If both the existing resource and proposed action can be expressed in terms of landscape elements, the nature of the potential impact and a way of mitigating it can be more readily understood. The composition of the aesthetic resources of the project area was assessed as follows:

- **Form**. The study area is located at the transition from valley bottom to mountainside. Landforms include glacial terraces, the "toes" or terminations of ridges, and drainages. Though slopes are quite steep, these landforms must still be characterized as rounded rather than angular. There are no large geologic features. The edges of landforms are generally softened by coniferous vegetation. Also, the study area is viewed against a background of higher terrain which is similar in appearance. Consequently, form is not a strong landscape element.

- **Line**. The edges of landforms and water bodies are the most common source of strong line elements in the landscape. As water bodies are not present, and landforms are generally rounded and vegetated with timber species, line elements are weak. Glacial terraces and those portions of

ridgetops which are not timbered contribute the strongest landform-derived line elements. These line elements tend to be horizontal rather than vertical.

- **Color.** Color elements within the study area are contributed primarily by vegetation. The study area is a mosaic of grasslands and various densities of coniferous and deciduous timber. While colors are limited to green, yellow, brown, and gray, there is enough contrast between them and vegetation type transitions are sufficiently abrupt, that color is a more influential landscape element than either form or line. Color is a stronger element in late summer and early fall than during winter, spring, and early summer. Seasonal changes in grasslands and deciduous species introduce browns and yellows, presenting a striking contrast with coniferous species.

- **Texture.** Texture is a strong visual element within the study area. Vegetation types are small and very diverse from a textural standpoint, ranging from open grasslands to dense forest. Species include Douglas fir, ponderosa pine, aspen, birch, and numerous shrubs, each of which contributes a different texture.

In summary, it can be said that while no single landscape element dominates the aesthetic resources of the study area, texture and color exert stronger influences than do either form or line. None of these elements could be described as remarkable within the study area in a regional context. Forms are rounded rather than angular. Lines are horizontal rather than vertical. Color elements are derived primarily from vegetation, and exert their strongest influence in late summer and fall. A diverse vegetative mosaic contributes a strong textural element.

4.9.2 Quality

The aesthetic resources of the study area are of moderate quality. The study area resembles most of the east side of the Sanpoil River Valley. It has none of the large geological features, water forms, or dramatic colors which are commonly associated with areas having higher visual

appeal (Curlew Lake, Lambert Creek, Kettle Crest, etc.). However, the study area exhibits considerably more visual appeal than nearby areas of uniform coniferous forest on rolling terrain.

4.9.3 Condition

Most of the study area is undisturbed, in terms of a percentage of acreage. However, most of the study area is not easily viewed. Views from the Wolf Camp Road are quite restricted by vegetation and topography. Within this restricted viewshed, the study area is heavily impacted visually. The existing gravel pit and drill road network dominate the view from the road. The area appears heavily disturbed and irreversibly damaged to the average viewer. From more remote viewpoints outside the study area, the situation is much better. Most of the disturbed areas cannot be seen, the exception being the upper drill road from approximately 3,050 to 3,225 feet above msl. As a result, the study area appears only slightly disturbed from most local viewpoints.

4.9.4 Visibility

The visibility of the study area was evaluated relative to the following roads, recreation sites, and residential areas:

- Wolf Camp Road;
- State Highway 21;
- County Road 203;
- Curlew Lake State Park; and,
- Pollard Residential Area.

Visibility was evaluated by inspection aided by topographic maps, photographs, and notes. No quantitative analyses were performed. The results of this assessment are as follows:

- **Wolf Camp Road.** Visibility from Wolf Camp Road is primarily restricted to the foreground within the study area. From the vicinity of the Echo Bay core shed to approximately 2,850 feet above msl, the road is in a narrow drainage. Views to the west are restricted closely by the ridge above and to the west of the existing gravel operation. Views to the east are restricted primarily by vegetation, though the ridge to the east ultimately restricts views to less than one-half of a mile. At approximately 2,850 feet above msl, the road leaves the drainage and enters an area of more gentle slopes. The area to the west of the road is quite flat, but views are closely restricted by coniferous timber. To the east, visibility is variable, from as little as several hundred feet to as much as a third of a mile. Again, the ridge ultimately restricts views to the east. At approximately 3,000 feet above msl, the road passes over a saddle and turns more toward the east. Visibility increases dramatically at this point, but this part of the road is visually removed from any proposed actions.

- **State Highway 21.** Traveling north from the junction with State Highway 20, the study area is initially visible from near the intersection of County Road 284. The south-facing slopes on the "toe" of the ridge above and to the west of the existing gravel operations are visible. These slopes are sporadically viewed until the vicinity of County Road 290, after which they are viewed continually. As one approaches the intersection of Wolf Camp Road, visibility of the study area increases. The higher elevations on the west-facing slopes in the eastern portion of the study area are viewed. Continuing north, visibility in the direction of the study area is restricted to the immediate foreground by topography at the turnoff to Curlew Lake State Park. Only the west-facing slopes immediately adjacent to the east side of the highway can be seen. Visibility in the direction of the study area increases again where State Highway 21 turns west approximately one-half mile north of the turnoff to Curlew Lake State Park, but one is essentially past the study area at this point.

  The study area is first seen from the vicinity of the Lambert Creek Road when traveling south from the town of Curlew on State Highway 21. Only north- and northwest-facing slopes at higher elevations in the eastern portion of the study area are visible. As one continues south, west-facing slopes come into view. Visibility of the study area is greatest in the

vicinity of Dollar Bar Beach Road, but is still limited to west-facing slopes immediately adjacent to the highway and at higher elevations on the eastern edge of the study area. Topography restricts visibility to the immediate foreground a short distance south of Dollar Bar Beach Road. Visibility toward the study area remains restricted until the turnoff to Curlew Lake State Park, beyond which one has a brief view of the southern portion of the study area; specifically of the mouth of the drainage in which the Wolf Camp Road is located, and of the west-facing slopes to the east of the mouth of the drainage.

- **County Road 203**. Traveling north from Republic, the study area is first seen from immediately south of the turnoff to the crossover road which leads to State Highway 21 at Torboy. This view of the study area is similar to the initial view of the study area when traveling north on State Highway 21 (see previous discussion). As one continues north on County Road 203, the west-facing slopes within the study area begin to be visible. Visibility of the study area becomes most extreme in the vicinity of the turnoffs to Pollard and Trout Creek. From this vicinity, only the lower portions of the west-facing slopes within the study area are screened from view. All east-facing slopes and flat areas within the study area are screened relative to County Road 203, however. Visibility toward the study area is quickly reduced as one continues north on County Road 203 from the Trout Creek turnoff, as one is essentially past the study area at this point. Views of the study areas while traveling north on County Road 203 are similar to those encountered while traveling south on Highway 21, though they are more extensive. North- and northwest-facing slopes at higher elevations in the eastern portion of the study area are first seen near the north end of County Road 203, in the vicinity of Kiwanis Road. Continuing south, more west-facing slopes come into view. Visibility of the study area is greatest in the vicinity of Trout Creek Road, as discussed above relative to traveling north on County Road 203. Within less than a mile of Trout Creek Road, one is past the study area and visibility is eliminated.

- **Curlew Lake State Park**. Visibility of the higher elevations of the southern portion of the study area is excellent from Curlew Lake State Park. The state park is less than one mile from the center of the study area, and is sited so as to have an excellent view up the Wolf Camp Road drainage. Most south- and west-facing slopes on both sides of the Wolf Camp Road drainage are visible. However, east-facing slopes are not visible. Visibility is greater from the picnic area than from the campground, which benefits from both vegetative and topographic

screening. The areas directly surrounding Portals #1 and #2 are not directly visible from the State Park.

- **Pollard.** The Pollard residential/recreational area is on the west side of Curlew Lake, almost directly west and slightly more than one mile from the center of the study area. Located to the north of Curlew Lake State Park, the Pollard area does not afford an extensive view up the Wolf Camp Road drainage, nor are south-facing slopes as visible, but the views of west-facing slopes are extensive. Many residences are constructed to take advantage of views toward the lake, also the direction of the study area. There is little vegetative screening, again by design in many cases.

Visibility of the study area is summarized in Figure 6 and Table 8. The figure is an approximation of the portion of the study area that is topographically visible from the travel routes, recreation areas, and residential sites which have been discussed (with the exception of Wolf Camp Road). The table provides information about the visibility of specific project areas. These areas are identified on Figure 3, Echo Bay's existing/proposed disturbance map.

Echo Bay has disturbed or proposes to disturb sites both north and south of the large block of patented claims which it controls. Disturbance areas A, B, C, D, and E are north of the block of patented claims; areas F, G, and H are to the south. Sites which have been disturbed or which are proposed for disturbance in areas A, B, C, E, and G are not visible from any of the viewpoints outside the study area identified in Table 8. Within Area D, the two drill sites and associated roads proposed for disturbance are topographically visible from all viewpoints except Curlew State Park, but high vegetative screening, relatively gentle slopes, and the north aspect (most views are from the west) will reduce visibility to nothing or very little. Both existing and proposed disturbance sites within Area F are visible from all viewpoints shown in Table 8. Area F contains two existing and one proposed road alignment. Of the existing roads, the higher road is the most visible, particularly where it traverses the west- and southwest-facing slopes in the north part of Area F. Slopes are steep here, and bedrock is near the surface. As a result, the roadcut is relatively high, essentially vertical and composed principally of exposed bedrock which is not weathered. Vegetative screening is only moderate. This portion of the road is

highly visible from most viewpoints below and to the west. As this road continues south, it turns to the east and traverses south- and southwest-facing slopes which are much less steep that those just discussed. The road is much less wide, and cuts are predominantly soil rather than rock. These factors combine to greatly reduce the visibility of the road in this areas, in spite of little or no vegetative screening. The lower of the two existing roads is much less visually obtrusive. The upper eastern portion is in a grassland area, but benefits considerably from vegetative screening to the west. In addition, this portion of the road is in an area of very gentle slopes, and runs nearly parallel to the prevailing lines of sight from viewpoints to the west. These factors effectively eliminate visibility of this portion of the lower road. The lower road enters coniferous timber as it continues west, turns to the north, and ends. Vegetative screening is high and slopes are sufficiently moderate that visibility from below and to the west is eliminated. The end of this existing road marks the beginning of a proposed road alignment which connects with another existing road in Area H. This proposed alignment traverses an area of moderately steep west-facing slopes having high vegetative screening. Visibility relative to viewpoints below and to the west will be reduced, but not eliminated by this screening. This scenario is borne out by the existing road in Area H, which is partially visible from viewpoints to the west, in spite of high vegetative screening.

Relative to the Wolf Camp Road, the majority of existing and proposed disturbance sites in all Areas except F and G are topographically visible. Vegetative screening restricts views of sites in the western portion of Areas A and E; and the eastern portion of Area D. The west-facing slopes in Area F are topographically visible, but benefit from moderate-to-high vegetation screening relative to the Wolf Camp Road. The south-facing slopes within Area F are topographically screened relative to the road. As a result, only the proposed road alignment in

Area F has any potential for visibility from the Wolf Camp Road, and even this is not likely. Area G is completely screened by topography relative to the Wolf Camp Road.

4.10 Cultural and Historical Resources

Two cultural resource surveys of the Lamefoot Study Area have been completed, one on BLM administered public lands and one on private lands to be affected by underground exploration. These studies are included in Appendix C. No significant cultural resources were identified within the study area on either public or private lands.

4.11 Socioeconomics

4.11.1 Employment, Labor Force, and Unemployment

Ferry County's economy is based primarily on agriculture, timber, and mining. Agriculture and mining employment have both increased in recent years, while employment in the timber industry has declined.

The largest sector in the Ferry County economy is the government sector with a 1989 total of 569 employees or 22 percent of total employment and 20.5 percent of total earnings. The next largest employment sector is the service industry, with 463 employees or 18 percent of total employment, but only 10 percent of total earnings. This reflects the generally lower wage scale in the service industry.

The largest basic sectors in the county are manufacturing (primarily wood products) and mining. Basic industries are those that sell their goods and services outside the county. The manufacturing sector had 343 employees in 1989, which was 13 percent of total employment and 14 percent of total wages, down from 19.5 percent of total employment and 24 percent of total wages in 1980. The Orient Lumber Company mill closed in 1989, which is probably not completely reflected in the Bureau of Economic Analysis (BEA) statistics for that year. Employment at the Vaagen Brothers Lumber Company has fluctuated in recent years, and is likely to continue to fluctuate (Allen 1991).

During 1989, the mining sector had 247 employees or 9.5 percent of total employment with 19 percent of total earnings, reflecting the substantially higher wage scale in the mining industry. Currently, there are two major mining operations in Ferry County—the Hecla Mining operations near Republic with 125 employees (Trico Economic Development District 1990) and Echo Bay's Kettle River Project. As of July 1991, Echo Bay is the largest employer in Ferry County with approximately 185 employees (Hewitt 1991; Trico Economic Development District 1990). Of those, 131 are hourly, nine are temporary, and about 45 are salaried. Approximately 32 percent of the hourly workforce has been hired from the local (tri-county) labor pool, 33 percent were drawn from elsewhere in Washington, and 35 percent migrated from out of state to work at Echo Bay's operations in Ferry County (Hewitt 1991).

Echo Bay's annual payroll is approximately \$7.5 million with an additional \$2.6 million in benefits. Without considering the effects of inflation, this payroll represents about 13 percent of total 1989 Ferry County earnings.

Table 9 displays labor force, employment, and unemployment data for Ferry County for the 1985 through 1990 period. These data represent employed and unemployed workers who live in Ferry County and are covered by unemployment insurance. In 1989 there were 2,571 jobs in Ferry County as reported by the BEA and 2,850 resident workers covered by unemployment insurance. This indicates that a large number of workers commute outside of Ferry County for employment. In fact, many Ferry County employees do commute to other counties for work. Ferry County residents who work on the Colville Indian Reservation commute to tribal headquarters in Okanogan County for work, as do many residents who work at various mills and other manufacturing businesses in Okanogan and Stevens counties (Allen 1991).

While the Ferry County labor force (employed workers and those unemployed who are looking for work) has increased by 720 in the five years between 1985 and 1990, employment has increased by 800, resulting in a decrease in the county unemployment rate (from 14.1 in 1985 to 8.5 in 1991).

During 1989, the [illegible]

percent of total exports [illegible]

Currently, there [illegible]

the Republic with 12% [illegible]

[illegible]

The largest employment gains in Ferry County during the last nine years have been in the service sector (177 jobs) and the retail sector (155 jobs). The mining sector posted a 97-job increase between 1988 and 1989, and much of the increase in the service and retail sectors is attributable to the growth in the mining industry (Allen 1991). In addition, many merchants in the county have positioned themselves to take advantage of the relaxed trade restrictions with Canada. It is also anticipated that tourism may increase slightly with the recent fossil discoveries at the Stone Rose Interpretive Center (Allen 1991). The largest employment losses in Ferry County occurred in the manufacturing sector which lost about 60 jobs over the nine-year period.

4.11.2 Population

Table 10 presents recent population trends in Ferry County. Population grew from 5,811 in 1980 to 6,295 in 1990, an increase of eight percent over the ten-year period. Of the total 1990 Ferry county population, 85 percent live in unincorporated portions of the community and 15 percent live in the incorporated town of Republic.

4.11.3 Local Government Tax Revenues

Sales and Use Taxes. The state of Washington imposes a sales tax of 6.5 percent on the sale of all tangible goods; the state imposes a use tax of 6.5 percent. Local governments in the state impose additional sales and use taxes, varying in amount from 0.5 percent to 1.7 percent. The local sales and use tax is consistent throughout a county, whether it is imposed within or without a municipality. In Ferry County, for instance, a one percent sales and use tax is levied. If a purchase is made in Republic, the one percent accrues to the city; if a purchase is made in a rural portion of Ferry County, the one percent accrues to the county (Vickers 1991).

Ad Valorem Tax. Property is assessed at 100 percent of its fair market value, based on comparable sales. Most property is appraised every four years, but gold mines are appraised

The largest predominant [illegible] in Kerry County [illegible] species [illegible] and [illegible] (58 [illegible]). [illegible] between 1991 and 1993 [illegible] in the [illegible] its present form [illegible] In Kerry County [illegible] this period.

[illegible]

[illegible]

[illegible]

[illegible]

annually. The value of a gold mine includes tangible and intangible worth, including its present worth, the price of gold, the right to increase reserves, as well as the value of equipment (Sweetman 1991).

Total fiscal 1991 property tax revenues in Ferry County are projected to be approximately $2,380,000 for all taxing jurisdictions (Ferry County 1991b).

Other Taxes. The state imposes no severance tax but does exact a small tax on gross sales or income. This business and occupation tax includes an extraction class that applies to logging and mineral extraction, including gold mines. The current rate is .484 percent of the total gross receipts or $4.84 per thousand of gross income (Lee 1991; Sweetman 1991).

Section 5

5.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

5.1 Impact Analysis Process

This chapter provides an analysis of the potential environmental consequences that could result from implementation of the proposed action. The impact analysis presented in this chapter addresses major project components and actions associated with the proposed Lamefoot Action. For the purposes of this EA, environmental consequences, or impacts, are defined as modifications in the status of the environment as it currently exists (as described in Chapter 4) that would result from project implementation.

Evaluation or analysis of environmental consequences involves the initial determination of the types of impacts resulting from the proposed project. The criteria for determining the types of impacts that could occur include resource activities; resource quality, or the present condition of the resource potentially affected; resource quantity, or the amount of the resource that could be affected; and duration of impact, or the period of time over which the resource would be affected. The duration of environmental modification is also important to impact analysis. Impacts that would occur over a long period or would be permanent are considered long-term impacts, while impacts that would be temporary are considered short-term impacts.

Impacts may be positive (beneficial) or negative (adverse) and may occur as a direct result of the proposed project (direct impacts) or as a secondary or subsequent result of the proposed project (indirect impacts). The importance of impacts is determined by a set of significance criteria. These criteria are resource-specific and define the threshold, type, or quantity of impact that would warrant special attention, such as special mitigation. The criteria are based on government regulatory standards and management directives, available scientific documentation, previously prepared environmental documents, and the professional judgement of resource specialists.

Certain measures that would reduce potential environmental impacts have been proposed in the project design and therefore have already been included in the description of the proposed project in Chapter 2. These measures have been taken into consideration in this impact analysis.

Upon completion of the impact analysis process, mitigation measures that would further reduce the severity of potential impacts were developed. These measures are summarized in this chapter and are spelled out more specifically in Appendix D, Reclamation.

The bottom-line objective of the environmental impact analysis is to determine if residual unavoidable, adverse impacts would occur after the implementation of mitigation. These impacts, known as unavoidable adverse impacts, become one of the important pieces of information to be used in the agencies' decision-making process.

The issue of how to address cumulative impacts is a difficult one, given the range of activities that are conducted within any given area in even the less industrial, more rural portions of our country, such as Ferry County. Even in these rural areas, multiple land uses are the rule rather than the exception, thus making land use planning a challenge for any land management agency, be it federal, state, or local.

In addressing cumulative impacts, it is imperative to factor in existing and historic land uses. In the case of Ferry County and, in particular, the immediate Republic vicinity, mining and less intensive land uses (e.g. wildlife habitat, dispersed recreation, timber harvesting, and livestock grazing) have co-existed throughout recent history (i.e., the last 100 years). While the impacts of these activities on the land are in no way negated by this history, evaluation of current and future cumulative impacts associated with these activities must certainly take into account the fact that together they provide the livelihood for most Ferry County residents as well as providing the county's economic base.

All of the resource areas addressed in this document were evaluated for cumulative impacts. In the analysis of cumulative impacts associated with the Key Project, the focus will be on the existing and proposed projects and activities identified above, along with the proposed action. as these impacts relate to the various resource areas.

5.2 Summary of Potential Impacts

This section summarizes the potential project impacts delineated in the environmental assessment. These potential impacts are discussed in detail in following sections of this chapter.

5.2.1 Potential Environmental Impacts

The environmental assessment for the Lamefoot Project delineated four potential impact areas which could be associated with the drilling and underground exploration activities. It should be noted that the assessment evaluated drilling activities on public lands. The assessment also evaluated the potential for impacts associated with the underground exploration activities. The underground exploration activities include portal development on private lands. The portal leads to a decline to access the underground exploration activities. The decline crosses a portion of BLM-administered lands.

The four potential areas of impact include the following:

- deer winter range
- visual aesthetics
- stability/erosion
- wetlands

Each of these potential areas of impact is summarized below.

Deer Winter Range

As discussed in Section 5.7, deer may temporary avoid the project area due to human presence, traffic, road construction, and helicopter activity. The project area is small in comparison to the entire winter range available to the deer, and there does not appear to be a unique habitat in the project area. Therefore, actual impacts to deer winter range will be minimal and deer can easily migrate to areas outside of the winter range.

Visual Aesthetics

Potential visual impacts are discussed in Section 5.10. For the drilling sites, only west-facing slope disturbances in Areas F and H have the potential for visible impacts outside of the study area, specifically from State Highway 21 and County Road 203. The contrast between the vegetation and exposed bedrock will be observable from several points. The visual impact is not expected to be severe and the disturbances for the drilling activities are not unique. There are enough existing roads and other surface disturbances that the introduction of a few scattered drill pads will not detract from the natural character of the landscape.

The portal for underground exploration and the associated facilities to be constructed on private lands will be visible from State Highway 21 and surrounding areas. The activities will add visual contrast to the area due to both changes in landform and changes in color through exposure of rock.

Stability/Erosion

The soils on steep slopes within the project area have the potential to erode. Echo Bay presents an erosion control plan which includes diversion of surface runoff, velocity controls for runoff, breaking up long slope lengths, revegetation, backfilling of erosion gullies, and maintenance of erosion control structures as necessary. If erosion is severe, Echo Bay will employ erosion

control matting to control the erosion and allow establishment of revegetation. Erosion control measures are discussed in Section 5.3 and 5.9.

Most of the disturbed areas are in shallow slope areas and reclamation and long-term stability is not a concern. The steep slopes created in Area H may create stability concerns upon completion of reclamation. Once reclamation of the slopes in this area is imminent, Echo Bay will complete an engineering study of the long-term stability of the proposed reclamation of this slope. During operations, the stability of the overcast material in this area will be periodically visually evaluated, especially after periods of heavy rain or spring breakup.

Wetlands

The potential impact to wetlands is associated with mine dewatering which could dry up wetland areas. As discussed in Section 5.8, the mine dewatering is expected to occur only at depth. There is no indication that substantial mine dewatering will be necessary near the surface. If substantial dewatering occurs near the portal entries, Echo Bay will visually monitor the spring and wetland area north of Portal #1 to determine if the dewatering is impacting the wetland areas. If there is an impact, Echo Bay will work with the appropriate agencies to develop a mitigation plan.

5.2.2 Potential Impacts of Portal #2

Portal #2 is located north of Portal #1. This alternative contemplates use of Portal #2 in place of, or in addition to, Portal #1.

Portal #2 would disturb less land than Portal #1 (7.2 acres for Portal #2 versus 15.1 acres for Portal #1, however the lower site would still be required for storage and shop areas. Therefore, some disturbance of the lower areas would be necessary even if the Portal #2 option was selected. In addition, the Portal #2 location is closer to adjacent private lands and hauling,

blasting, dust, and noise could have a greater impact on the adjacent private landowners. The haulage traffic would use Wolf Camp Road along with the private landowners increasing the potential for accidents. The proposed Wolf Camp Road relocation would not divert mine traffic for the Portal #2 except in the southernmost portion of the road.

Finally, the site of Portal #2 is steeper than Portal #1 and may cause erosion or slope stability problems requiring remediation.

5.2.3 Potential Impacts of the No Action Alternative

The no action alternative contemplates no further exploration on BLM-administered lands. Since the area has already been disturbed by exploration activities, the area will be disturbed even if no further exploration were to occur. Existing roads and previous drill pads would require reclamation and mitigation of impacts.

In addition, the no action alternative may preclude Echo Bay from pursuing a mining operation on federally managed lands in accordance with the General Mining Law of 1872. The resource would, however, remain in place as a potential recoverable deposit for future mining.

The no action alternative could also increase unemployment since workers at Echo Bay's Kettle River project would be laidoff at the completion of that project instead of being transferred to the Lamefoot Project should an economic reserve be identified. This could result in loss of income to the local area.

5.3 Hydrology: Surface Water and Groundwater Resources

5.3.1 Surface Water

Surface water control plans for the Lamefoot project have been developed to ensure that surface waters entering or originating within the permit boundaries are, to the extent reasonably possible, unaffected by project activities. Since no perennial waters transect within the permit boundaries, surface water control will be implemented primarily through the construction of structures to divert precipitation runoff around project facilities. Such diversion will essentially eliminate the potential for contact between surface waters and project activities which might adversely affect those waters.

As designed, the Lamefoot project will produce minimal surface disturbance; however, some increase in the rate of erosion and sediment transport over pre-development levels is inevitable. Consequently, sediment control structures will be designed to detain flows originating from disturbed surfaces sufficiently long to allow sedimentation to occur behind the structures prior to planned infiltration.

Where surface waters are diverted around the project disturbance areas, measures will be taken to dissipate energy from flows and minimize runoff erosion by placing any bales where surface flows are concentrated. Aprons constructed of rock, gravel, brush or logs will be placed as a drop structure wherever surface flows encounter a break in slope and where water courses terminate. This will further dissipate energy, minimizing soil erosion. Sediment control structures and catch basins will be cleaned and upgraded periodically as required, to prevent overflow and distribution of sediments.

Erosion control measures to be implemented during operations and reclamation are discussed in detail in Appendix D, Reclamation. Such measures will initially include backfilling of erosion gullies, revegetation, and check structures, where necessary. If these measures fail to inhibit

erosion, erosion matting will be considered. Some flexibility is necessary in selection and location of erosion control measures in order to ensure that the best method is chosen for the specific conditions encountered during operations. The measures described will control erosion, minimize the amount of sediment transport and aid in re-establishment of revegetation upon reclamation.

5.3.2 Groundwater

On the basis of existing study area groundwater and geological data, it seems most likely that any groundwater encountered during exploration activities will be from fracture-controlled perched groundwater tables. The amount of water associated with perched and fracture-controlled tables is expected to be minimal. However, any water encountered during underground exploration activities which is not used in mining processes will be pumped and diverted to the settling/infiltration ponds shown on Figure 3. No adverse impacts to groundwater resources are expected to occur.

Because of the complex fracture flow hydrogeology of the bedrock in the portal vicinity, it is not known what impacts may potentially affect the springs and wetlands in the study area. Echo Bay will visually monitor the surface flows in the vicinity of the wetlands for impacts which could be related to dewatering activities. As discussed in Chapter 4.0, most of the dewatering activities are expected to occur in deeper portions of the exploration development. In addition, the dry climatic conditions being experienced by this part of Washington may affect wetlands as well. Should Echo Bay's observations show a potential for wetland impacts, the appropriate agencies will be notified and a mitigation plan developed for review and approval.

Although not expected to occur, any impacts to the Heckly well west of the study area will be mitigated. Echo Bay will work with the owners of the well to develop appropriate and satisfactory mitigation measures, if necessary.

5.4 Air Quality

Dust would be the only substantial air quality concern generated by the proposed Lamefoot Project. Dust at other mining projects in the region has been effectively controlled through the implementation of various common dust control measures (e.g., watering of haul roads). Thus, although the potential does exist for some adverse air quality impacts to result from any mining project, the likelihood for a major problem at Lamefoot would appear to be slight. Appropriate air quality permits, if required by commercial production, will be obtained from Washington Department of Ecology (DOE).

5.5 Noise

The Lamefoot Project will be operated in compliance with both federal and state noise standards; consequently, no significant adverse impacts would be anticipated. However, the project would generate noises not currently part of the existing environment, thus warranting the implementation of the state-of-the-art noise reducing measures described below.

In general, noise-producing activities associated with the Lamefoot Project Surface exploration program will be those typical of any similar exploration project. The major noise sources will include the operation of road construction equipment, light vehicles, and drills. Compressors, increased vehicular traffic, occasional blasting, and ventilator fans will contribute to the noise levels as a result of the exploration program. For the most part, after the initial site construction phase, the noise levels generated from the sources other than the ventilator fans will be barely noticeable beyond the study area boundaries. Ventilation fans and compressors associated with underground mines can be irritatingly loud, particularly in areas where dense vegetation is not present and does not provide a level of noise attenuation sufficient to adequately absorb fan noise to acceptable levels. Echo Bay is acutely aware of this concern, given a similar concern raised by residents in close proximity to the existing Kettle Mine.

Ventilator fan noise at Lamefoot will be mitigated by construction of a berm of growth medium and planting of trees along the berm to muffle the fan noise. Additionally, deflectors will be installed to direct the noise upwards and mufflers will be used to further reduce sound. The compressor will be placed in a building to further reduce the noise impacts. Once the exploration activities have progressed far enough underground, the fans will be moved underground within the first 200 feet of the portal entry, thereby entirely eliminating the noise from this source.

Overall, noise levels will be greatest during site and portal construction lasting approximately two months. The use of heavy equipment and the need for surface blasting will unavoidable contribute to the noise levels of this area.

5.6 Light and Glare

Although some light and glare from project activities will be unavoidable, particularly when foggy or cloudy, steps will be taken to minimize the impacts. All project lights will be hooded and directed toward the interior of the project area rather than toward outside areas.

5.7 Wildlife

The proposed exploration program could affect wildlife in several general ways: habitat loss, increased human activity, and habitat alteration. Given the relatively small size of the area to be disturbed (approximately 2.42 acres on BLM-administered land and 15.6 acres on private land for this proposed disturbance and approximately 6.86 acres on BLM lands and 20.6 acres on private lands since the start of the exploration program), the impacts of habitat loss are expected to be correspondingly small. The magnitude of the effects of habitat loss, however, depend on the type of habitat affected. Elimination or alteration of habitats that represent a small but important part of the study area, such as wetlands or aspen groves which provide greatly increased habitat diversity for wildlife, would have a larger adverse impact than loss of more

extensive conifer forest habitat, for example. Because the drilling program proposal has been modified to exclude any disturbance to wetlands and road relocation on private lands will also avoid these areas, it appears that all of the habitat likely to be disturbed by exploration activities occurs in abundance throughout the region.

Increased traffic to the study area will cause a small increase in the risk of wildlife being struck by motorized vehicles. However, since the proposed drilling program is a continuation of an ongoing program, it is unlikely that any change in the traffic patterns of recent years will occur with regard to drilling. The proposed diversion of Wolf Camp Road near Portal #1 will limit most public traffic to one small portion of the study area.

Alteration of habitat could include siltation of streams and wetland areas, which could affect water quality, and therefore, amphibians and other species dependent on good water quality.

The continuation of exploratory during October to March east of Wolf Camp Road will continue to affect mule deer use of the winter range. The extent of this impact is unknown, however, the abundance of various aged deer sign in this winter range area indicates that deer use of the area has continued to date. Deer can be expected to be adversely affected by human presence, traffic, road construction, and helicopter activity during the winter period. Deer may react by avoiding this area and moving to more remote adjacent portions of the range. The proposed disturbance area is realtively small compared to the entire winter range available. Generally, increased disturbance could result in increased stress at a time when deer are in poor condition, and adversely affect either overwinter survival or reproductive success. Deer are in an energy deficit state during the winter. They must burn stored fat to survive because they cannot obtain sufficient nutritional forage to maintain their body weight.

No threatened or endangered species are expected to be affected by this project.

5.8 Vegetation and Wetlands

As currently proposed, the drilling program would have no effect on any of the wetlands in the Lamefoot Study Area. Vegetation would be removed from 2.42 acres of BLM-administered lands in order to conduct the proposed drilling program. A total of 4.44 acres of BLM-administered lands has been previously disturbed. Because rock and soil substrates are unstable in the steeper portions of the study area, any disturbance in steep areas has the potential to impact vegetation resources through loss of topsoil, loss of fertility and increased sedimentation in wetlands and streams. The magnitude of this potential impact can be effectively controlled through the implementation of adequate reclamation and erosion control practices (see Appendix D). In particular, it will be important to utilize species that quickly establish a ground cover and anchor the soil during the first growing season after disturbance. Refer to Appendix D for the seed mix recommended by project soils and vegetation resource specialists.

The proposed underground exploration activities could affect the vegetation in three ways: wetland loss, destruction of a sensitive species, and loss of habitat through soil erosion. Wetlands can be impacted directly through road construction, drilling, or any other activity that results in placing fill in the wetlands. In this case project activities have been located to avoid placement of fill in the wetlands. They can also be impacted indirectly through any activity that changes the hydrologic processes that provide water to the wetlands. For example, destruction of a spring upslope would result in dewatering of a wetland fed by the spring. The one sensitive plant species on the site is associated with wetlands, so negative impacts on the wetland habitat of the species could result in loss of the plant population as well. This is discussed in more detail in following paragraphs. Finally, rock and soil substrates are very unstable in some of the steepest parts of the study area. Any disturbance that exacerbates this instability and increases erosion would impact vegetation resources through loss of topsoil, loss of fertility, and increased sedimentation in wetlands and streams. Erosion control measures are discussed in Section 5.3.

The specific wetlands concern associated with underground exploration has to do with the southernmost wetland area shown on Figure 4. This wetland area is located in close proximity to some of the site facilities shown on Figure 3. However, siting of these facilities was coordinated with the wetlands resource specialist (Ms. Loverna Wilson), and adequate buffers have been retained to avoid wetlands impacts. Specifically the following considerations were taken into account when planning the site layout:

- The diversion of Wolf Camp Road was sited south of the wetlands because the wetlands hydrology comes from drainages and springs to the north of the wetland area. Thus, the road will not interrupt hydrologic patterns that provide water to the wetland;
- Surface drainage from the road will be designed to drain to the south rather than into the wetland to the north. This will keep non-point-source pollution from road surface runoff out of the wetlands;
- A 50-foot vegetated buffer will be left between the road edge and the wetland edge. This will protect the wetland from siltation, vehicle disturbance, and surface runoff;
- A small diversion ditch will be constructed on the north side of the road to ensure that no runoff from the road may enter the buffer zone; and,
- During construction, all heavy equipment and staging areas will be kept on the south side of the proposed roadway to avoid soil compaction and vegetation damage to the wetland areas on the north side. The only disturbance north of the road will be a small parking lot for employee vehicles and this will be located to the north and west of the wetlands. The parking lot will be designed such that drainage from it is directed away from the wetlands.

In addition, the potential for effects of wetlands areas from dewatering activities associated with the underground exploration is minimal. Near surface groundwater is highly unlikely in the areas proposed for underground entries. Drilling to date in the area has encountered little sustainable water flows in the near surface bedrock and significant water is not expected in excavating the underground exploration openings in bedrock planned in the underground exploration phase (see Section 5.3). In addition, structural trends in the project area which may

result in dewatering of the wetlands area and springs do not appear to be directly connected with the geologic features in the vicinity of the proposed underground entries. Should underground exploration indicate a viable mining project, additional studies will be performed on the effects of dewatering during development.

5.9 Soils

As with any mining project, surface disturbance can increase the risk of wind and water erosion, as well as result in compaction of topsoil material. Because the surface disturbance associated with the proposed project is anticipated to be relatively small (2.42 acres on BLM-administered land and 22.8 acres on private land), the effects to the soils resource would not be expected to be great. However, soils on steep slopes within the study area are classified as having a severe erosion hazard and will need to be handled with special care when they must be disturbed.

Where roads are constructed, water bars and open top culverts will be installed using the proper recommended spacing which applies to the gradient of the road. All ditches and CMP culverts will be designed for a 25yr 24hour storm frequency to adequately transport runoff flows as a result of snowmelt and precipitation events.

In general, all available topsoil material will be stripped and stockpiled prior to site disturbance. It is estimated that 3,865 cubic yards will be salvaged from drilling-related disturbances and that 200,000 cubic yards will be salvaged from site disturbances associated with underground exploration. The soil material salvaged from site preparation for underground exploration activities will be used to create a growth media storage berm paralleling State Highway 21. This berm will be seeded and will serve the dual function of topsoil storage and visual screening from the highway. Soils salvaged at drill roads and pads will be stockpiled immediately adjacent to each disturbed area and respread as soon as the area is no longer an active exploration site.

The proposed reclamation for the project exploration activities is presented in Appendix C. The reclamation proposes to backfill all drill holes in accordance with BLM requirements, replace topsoil on the drill pads and revegetate. Roads will be reclaimed by pulling material back on to the road surface to create a slope similar to the pre-existing slope which blends with the surrounding topography. The material will be placed in a manner which is stable and water will be diverted around steep portions to the extent possible. Excessively steep slopes will be reclaimed in this manner to the extent possible while keeping in mind safe equipment operating slopes and the need to ensure a stable post-project configuration. Monitoring for slope movement and erosion on the steep portions is recommended until any settling is completed and revegetation is established.

5.10 Visual Aesthetics

5.10.1 Drilling Program Impacts

With regard to the 1992 drilling program, only those disturbance sites within areas F and H have any potential for visual impact relative to those viewpoints outside the study area that were included in the analysis (see Section 4.8, Figure 6 and Table 8). Within these two areas, only those disturbance sites on west-facing slopes have potential for visual impact relative to those viewpoints such as State Highway 21 and County Road 203. The nature of these potential impacts is the introduction of a small (50 foot by 50 foot) geometric disturbance element which are made more visually obtrusive because of the color contrast between newly exposed soil and bedrock. Bedrock in this area is light gray, presenting a strong contrast to the dark green coniferous vegetation. However, little if any bedrock will be exposed since the roads originally proposed in these areas have been eliminated. The upper existing road in Area F is readily visible from viewpoints included in this study, especially County Road 203, Pollard, and Curlew Lake State Park. The proposed disturbances in Area F will benefit from more vegetative screening than does the existing upper road, but they will still be visible from the same viewpoints. The visual impact is not severe, however. In addition, the general area has enough

roads and other surface disturbances that the introduction of a few scattered drill pads does not significantly detract from the natural character of the landscape.

The potential for visual impact relative to the Wolf Camp Road is considerable. The majority of existing and proposed disturbance sites in Areas A, B, C, D, E, and H are visible from the Wolf Camp Road, at ranges from 0 to 300 feet. Roads will introduce line elements and color contrasts, as discussed above. Drill pads and landings will introduce form and color contrasts. Even allowing for the moderating effects of vegetation screening and fairly gentle slopes in Area A and E, visual impact will be moderate to severe from the Wolf Camp Road.

5.10.2 Underground Exploration/Facilities Impacts

The proposed Lamefoot Project will include the following components:

- Partial diversion of Wolf Camp Road;
- Adit;
- Dump for mine waste rock;
- Sediment pond for dump;
- Change room/dry;
- Parking Area;
- Laydown area; and
- Fuel Storage area.

Each of these components will introduce a particular kind of visual contrast to the project area. These contrasts are described in this section in terms of landscape elements: line, form, color, and texture.

Upgrade Access Road/New Access Road. A new section of county road will be constructed to replace the existing portion of Wolf Camp Road just north of where it intersects State Highway 21 (see Figure 3). Roads introduce horizontal line elements to the landscape. They are easily seen because of the color contrast between road cuts/fills and adjacent vegetated areas. Long,

straight, horizontal lines are uncommon in most natural landscapes, including the study area. The upgraded/new road segment will introduce a strong contrast, but will be so short (approximately 565 feet) that this effect will not be very pronounced.

Adit. Construction of the adits will introduce contrasting form, line, and color elements to the existing landscape. To the extent that local topography is altered, this will result in a contrast with local landforms. Activities that result in exposure of bare soil and/or bedrock will be evident because of the color contrast between these disturbed areas and adjacent vegetation. Slope stabilization may also require matting insert in areas that will alter the natural appearance. In addition, structures will introduce contrasts: forms contributed by the shapes themselves, and lines contributed by the edges. To the extent that the color of these structures is different from those found in the local landscape, color contrast will also be introduced.

Dump for Mine Waste Rock. The waste rock will constitute an introduced landform, and will contrast with existing topography to some extent. The waste rock dump will introduce contrasting color and textural elements as well. The color of the unweathered waste rock will contrast markedly with adjacent undisturbed areas, and the dump will appear much smoother than adjacent vegetation when viewed from a distance. The dump proposed for exploration work will be small and, therefore, a minor element in the overall landscape.

Sediment Pond. The sediment pond will require an embankment. The embankment will introduce the same kinds of visual contrasts as will the waste rock dump, but on a small scale. The embankment will constitute a small introduced landform, and the embankment will appear less textured than adjacent areas. Color contrast will be less than that of the waste rock dump, assuming that the embankment is constructed of topsoil or surface fines rather than unweathered bedrock.

Change Room/Dry. This structure will introduce contrasting form, line, and color elements to the project area, though a very small scale. To the extent that the color of the structure is

similar to that of adjacent areas, the contrasting form and line elements introduced by the shape and edges of the structure will be less easily seen.

Parking Area. The parking area will introduce contrasting color and texture elements to the local landscape. As has been described relative to several other components of the proposed project, such a disturbance is visually evident because the area is a different color and much smoother than the adjacent landscape. The parking area would also introduce a contrasting form element if it were to be constructed in an area with steep slopes. Since the parking area will be located in an area that is fairly flat, this kind of contrast in form will not be introduced.

5.11 Cultural and Historic Resources

There are no cultural or historic resources present on public lands within the study area (see Appendix C). Although there is an old adit and air compressor building present within the study area on private lands, these structures are not considered to have any historic significance. No significant impacts to cultural or historic resources will occur as a result of the Lamefoot Exploration activities.

5.12 Socioeconomics

5.12.1 Impacts Resulting From Drilling Activities

The 1992 drilling project will be of minor temporary economic benefit to the Republic and Curlew, Washington areas. The project will employ about 18 people for a period lasting up to 10 months. Approximately half of these people will be either Echo Bay employees or drillers who will travel to the project area and stay in either Republic or Curlew during each 10 day work period. The remaining work force will be comprised of Republic and Curlew residents. It is anticipated that each of the project workers who travel to the project area will spend about

$1,000 per month in living expenses. Assuming an average outside work force of nine people, approximately $9,000 per month would be spent in the Republic-Curlew area for lodging, meals, etc.

Additionally, the drilling project will create a temporary increase in demand for goods and services, which will be obtained locally from the Republic-Curlew area. The project is anticipated to have the following monthly demand for goods and services:

Hardware	$2,000/month
Fuel	4,000/month
Tire and Vehicle Maintenance	2,000/month
Lumber	2,000/month
Miscellaneous Supplies	2,000/month
TOTAL	$12,000/month

This $21,000 monthly contribution to the local economy does not include the wages earned by the Republic and Curlew residents employed during the 1992 drilling program.

5.12.2 Impacts Resulting From Underground Exploration

It seems unlikely that the proposed Lamefoot Project would increase the population of Ferry County enough to have significant effects on housing and services, particularly given the fact that most of the work force will be provided by current Echo Bay employees transferred from the Kettle River Project to the Lamefoot exploration program.

The project would almost certainly provide additional economic benefits to Ferry County and the state through revenues realized from the various taxes described in Section 4.10.3.

If the exploration program is successful and a positive production decision is made, the following additional revenues will be realized by state and local governments:

- The increase in revenues of the Kettle River project will add to the assessed property value. Consequently, the ad valorem taxes will increase.
- Increased longevity of the operation will result in more payroll, sales, and B and O taxes over time, as well as increasing the indirect benefits of spending by Echo Bay employees.

Section 6

6.0 CONSULTATION, COORDINATION, AND DISTRIBUTION OF THE EA

Numerous entities provided consultation and coordination during the preparation of this EA. Government agencies, elected representatives, and individuals provided input throughout the process. Resource task leaders (identified in Chapter 7) met with and telephoned various agency personnel as well as private and academic individuals and one another. Through the process of these contacts many issues were resolved, modifications incorporated into the proposed action, and mitigation measures developed.

The agencies and groups listed below were contacted and/or provided input to this EA. All of the federal, state, and local agencies listed will receive copies of the EA. In addition, file copies will be available for public review at the front desk of the Spokane District Office of the BLM.

Copies of the EA will be available on request (while supplies last) from the main desk at the Spokane District Office of the BLM or by sending written requests to the agency.

FEDERAL AGENCIES

U.S. Forest Service, Colville National Forest, Republic Ranger District
Bureau of Land Management, Spokane District
Soil Conservation Service

STATE AGENCIES

Washington Department of Ecology
Washington Department of Natural Resources
Washington Department of Revenue
Washington Natural Heritage Program
Washington Department of Wildlife
Washington Department of Fisheries
Washington Department of Community Development
Washington Department of Transportation

TRIBES

Colville Confederated Tribes

LOCAL AGENCIES

Ferry County Planning Department
Ferry County Auditor's Office
Ferry County Department of Public Works
Ferry County Assessor
Ferry County Commissioners

Section 7

7.0 LIST OF PRINCIPAL PREPARERS

This EA was prepared by Golder Associates, Inc. of Lakewood, Colorado and their subcontractors. All of the resources specialists involved in the preparation of this report have conducted other studies in eastern Washington and all are experienced in conducting baseline studies and impact analysis for mining projects. The principal preparers are listed below along with brief summaries of their relevant experience.

Jean Kiel - NEPA Coordinator and Soils Task Leader

Jean Kiel has both a B.S. and M.S. in Botany and Plant Pathology from Colorado State University. She has been an environmental consultant for 13 years, before which she worked as a mined land reclamation specialist in the private sector. Ms. Kiel has conducted baseline studies, prepared impact analyses, and reclamation plans for more than 20 mining projects in the western U.S. She has co-edited a book on heap leach mining technologies and has coordinated teams of resource specialists in the preparation of some 30 NEPA documents. Additionally, she has prepared several SEPA documents for projects in Washington State, most notably the Cannon Mine EIS for a major gold mine near Wenatchee.

Loverna Wilson - Vegetation and Wetlands Task Leader

Loverna Wilson has a M.S. in botany/plant ecology from Oregon State University. As a thesis project, she mapped the vegetation for 48 square miles of the Okanogan Highlands in the vicinity of Mount Tolman. She has been working as a botany consultant for 13 years, with most of her projects in the Pacific Northwest. Her areas of expertise include vegetation habitat analysis and plant community descriptions, vegetation mapping and aerial photointerpretation, wetland and riparian assessments and boundary delineations, endangered species surveys, and impact assessment and mitigation design.

Lynn Sharp - Wildlife Task Leader

Lynn Sharp has a B.A. in Biology from Knox College, Galesburg, IL, and a M.S. in Zoology from the University of Alberta, Canada. She has worked in government and private consulting in wildlife, terrestrial and wetland ecology, and environmental planning in the western U.S. and Canada for 20 years. Ms. Sharp has experience in conducting baseline studies and impact assessments, and preparing mitigation plans for gold mining projects in South Carolina, Oregon, and California. She has also conducted wildlife studies and mitigation planning related to ski area development, residential development, recreational trails, highways, transmission lines, pipelines, oil and gas exploration, coal mining, airports and bird hazards to aircraft, and urban natural area inventory studies.

Craig Laurie - Visual Aesthetics/Recreation Task Leader

Craig Laurie has a B.S. in Forestry from Northern University and a M.S. in Recreational Resources Planning from CSU. Mr. Laurie has worked as a visual resource analyst, land use planner, permitting/regulatory affairs specialist, and forester in the consulting industry as well as the private sector over the last 16 years. He has designed and implemented baseline studies,

impact assessments, and mitigation plans relative to visual resources for mining projects in Colorado, Montana, Wyoming, and Washington.

George Blankenship - Socioeconomics/Transportation/Land Use Task Leader

George Blankenship has B.A. degrees from Colorado State University and the University of Nebraska in Social Work and Anthropology, respectively, and a Master's degree in Urban and Regional Planning from the University of Colorado. Over the past 12 years, Mr. Blankenship has conducted and supervised socioeconomic and land use studies for over 30 mining projects throughout the western U.S. Mr. Blankenship is one of the founders of his firm, Planning

Information Corporation, and is responsible for project administration, socioeconomic analysis, and community and government relations projects.

Craig Holstine - Historic and Cultural Resources

Craig Holstine has a B.A. and M.A. from Washington State University. Mr. Holstine has experience in the field of cultural resources management, historical preservation, records and archival management, and writing client-contracted narrative histories. He has prepared nominations and determinations of eligibility for the National Register of Historic Places; prepared determination of effect requests; written memoranda of agreement and management plans; conducted Historic America Engineering Record (HAER) and Historic American Building Survey (HABS) projects; and compiled data bases and management recommendations for Environmental Impact Statements (EIS) and Environmental Assessments (EA). Mr. Holstine has conducted research in public and historical records at most of the research institutions in the Pacific Northwest, as well as in local courthouses, libraries, and museum archives. Mr. Holstine is the author of two books and numerous articles relating to Pacific Northwest history. He has reviewed manuscripts for publication and worked as an editorial consultant to a university press. Mr. Holstine teaches a course in cultural resource management at Eastern Washington University.

Section 8

8.0 REFERENCES

Fenneman, N., 1931. Physiography of the Western United States. New York, McGraw-Hill.

Ferry County, 1991a. Ferry County Application for Community Economic Revitalization Board Grant. Submitted April 1991.

Ferry County, 1991b. Final 1991 Budget.

Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA For. Serv. Gen. Tech. Rep. PNW-8. 417 pp.

Hewitt, W., 1991. Human Resources Administrator, Echo Bay Kettle River Operations. Personal communication with George Blankenship, Planning Information Corporation. June 20, 1991.

Lee, J., 1991. Taxpayer Information Specialist, Washington State Department of Revenue. Personal communication with Andra Schmidt, Planning Information Corporation. June 17, 1991.

Mastrogiuseppe Environmental Consultants, 1991. Botanical Survey for Echo Bay Exploration, Republic, Washington. 29 p.

Muessig, Siegfried, 1967. Geology of the Republic Quadrangle and Part of the Aeneas Quadrangle, Ferry County, Washington: U.S.G.S. Bulletin, 1216.

Natural Heritage Data System, Washington Department of Wildlife - Nongame Program. Letter dated October 14, 1991. Mail Stop EX-2, Olympia, WA 98504.

Soil Conservation Service, 1979. Soil Survey of North Ferry county Area, Washington: Parts of Ferry and Stevens Counties. USDA Soil Conservation Service and Forest Service in cooperation with Washington Agricultural Experiment Station.

Sweetman, John, Ferry County Assessor. Telephone conversation with A. Schmidt, Planning Information Corporation. June 13, 1991.

Trico Economic Development District, 1990. Ferry County, Washington Profile.

U.S. Fish and Wildlife Service, 1987. National Wetlands Inventory map. Republic, Washington 7-1/2" quadrangle.

Vickers, T., 1991. Taxpayer Service Representative, Washington State Department of Revenue. Telephone conversation with A. Schmidt, Planning Information Corporation. June 13, 1991.

Washington Department of Wildlife, 1991. Species of Concern List, Nongame Program, Wildlife Management Division. 7 p.

Washington Natural Heritage Program, 1990. Endangered, Threatened and Sensitive Vascular Plants of Washington. Department of Natural Resources, Olympia. 52 pp.

Washington Department of Ecology (DOE), 1988. Final Environmental Impact Statement and Technical Reports, Kettle River Project, Ferry County, Washington. Issued September 23, 1988.

Tables

TABLE 1
CUMULATIVE SURFACE DISTURBANCE ON UNPATENTED LAMEFOOT CLAIMS THROUGH 1991.

Area	Claims Affected	Measures of Disturbance	Total*
"A"	LF 5,7	550' long x 8'-29'wide	4,400 sq.ft.
		Drill site and access added 9/91: access =65' x 15'=975 sq. ft.; drill site = 36' x 47' less original road width of 12' x 36' = 1,260 sq. ft.	2,235 sq.ft.
"B"	LF 7	200' long x up to 45' wide; recontoured 7/91, redisturbed 9/91	7,400 sq.ft.
"C"	LF 7,9	Approx 470' x 130'+ recontoured 7/91, partially redisturbed 9/91	18,780 sq.ft.
"D"	LF 9,11	Landing, irregular shape	23,300 sq.ft.
		Road 1=460'x 27-47'	17,020 sq.ft.
		Road 2=130' x 25'	3,250 sq.ft.
"E"	LF 9	Road 1=250'+x15'-28'	5,834 sq.ft.
		Road 2=470'x15'	7,050 sq.ft.
		Road 2, cuttings and run off	
		N. drill site = 100'x14'	1,400 sq.ft.
		S. drill site = 100'x23'	2,300 sq. ft.
"F"	LF 15, 16, 17	2,370' x 25'(av.)	59,250 sq.ft.
"G"	LF 14, 15, 16	1,900' x 12'(av.)	22,800 sq.ft.
"H"	LF 15	320' x 40'	12,800 sq.ft.
			193,319 sq.ft. or 4.44 acres

TABLE 2
REQUIRED PERMITS FOR LAMEFOOT PROJECT

FROM DEPARTMENT OF ECOLOGY (DOE)	
New Source Construction Approval Public Ground Waters Withdrawal Permit	RCW 70.95.152; RCW 90.44.050
Waste Discharge Permit	RCW 90.48.160
Air Pollution Source Regulation	RCW 70.94
FROM DEPARTMENT OF NATURAL RESOURCES (DNR)	
Burning Permit	RCW 76.04.150 & 170
FROM USFS and BLM	
Plan of Operation Approval	36 CFR 228; 43 CFR 3809
NEPA Compliance	1969 Environmental Policy Act
FROM FERRY COUNTY	
Substantial Development Permit	RCW 90.58.140
Ferry County Mining Ordinance	RCW 36.32.120
On-Site Sewage (Tri-County Health Department)	WAC 248.96

TABLE 3
ANTICIPATED SURFACE DISTURBANCE ON UNPATENTED LAMEFOOT CLAIMS DURING 1992

Description	Claims Affected	Measure of Disturbance	
Access trail and two drill sites. The access trail to be used was created as part of logging disturbance unrelated to exploration. We will now be using the trail and assuming responsibility for part of the disturbance.	LF 9, 10, 11, 12	▸main access trail: 1,000' x 30' = ▸access to drill sites: 2 @ 100' x 20' = ▸drill sites: 2 @ 30' x 30' =	30,000 sq.ft. 4,000 sq.ft. 1,800 sq.ft.
Drill station cut-outs, east side of Wolf Camp Road.	LF 7	Cut-outs: 3 @ 30' x 30' =	2,700 sq.ft.
Drill sites and access trails in areas "E" and "A". West of Wolf Camp Road. Access west from Wolf Camp Road will be via an existing road currently used to access a private residence. If Echo Bay's use of the road includes drilling, it will be added into the disturbance total.	LF 3, 5, 7, 9	▸access from Wolf Camp Rd. via existing road: 500' x 25' = ▸new roads: 820' x 25' = ▸drill sites: 21 @ 30' x 30' =	12,500 sq.ft. 20,500 sq.ft. 18,900 sq.ft.
Helicopter - supported drill pads in areas "F" and "H". Pads will be manually cleared to avoid any additional disturbance by large equipment.	LF 15	▸drill sites: 6 @ 50' x 50' =	15,000 sq.ft.
		TOTAL DISTURBANCE	105,400 sq.ft. or 2.42 acres

TABLE 4
ANTICIPATED SURFACE DISTURBANCE ON PRIVATE FEE LAND DURING 1992

Description	Measure of Disturbance
Alternative #1 Exploration Portal #1 Located on Private Property Just North of the Intersection of Wolf Camp Road and State Highway 21	15.1 acres
Alternative #2 Exploration Portal #2 Located on Private Land Approximately 3/4 Mile NE of Portal #1, Above Wolf Camp Road	7.2 acres

TABLE 5
EQUIPMENT REQUIREMENTS FOR THE LAMEFOOT EXPLORATION PROJECT

EQUIPMENT TYPE	NOMINAL SIZE	NUMBER REQUIRED
Drilling Program Equipment		
Truck-mounted reverse circulation rotary drill rigs	DK-40	1
Track-mounted reverse circulation rotary drill rig	LK8-C	1
Truck-mounted diamond core rig	LY-44	1
Skid-mounted diamond core rig		2
Combination water and drill pipe truck	2,000 gal.	3
Bulldozer	D-8	1
Portal Construction/Underground Exploration Equipment:		
Crane		1
Drill Jumbo		2
Six-yard Scoops		4
Welding Truck		1
Air Truck		1
Compressors		2
Generators		2
Scissor-Lift		2
25-ton Haul Truck		2
Loader	966	1
30-ton Underground Truck		4
Powder Truck		1

TABLE 6
CUMULATIVE LAMEFOOT PROJECT DISTURBANCE PROPOSED THROUGH 1992

	Disturbance on Unpatented (BLM-Administered) Lands (acres)	Disturbance on Private Lands (acres)	Total (Cumulative) Project Distribution (acres)
Drilling Disturbances Through 1991	4.44 acres	5.0 acres	9.44
Proposed Drilling Disturbances	2.42 acres	0.5	2.92
Proposed Portal Construction and Underground Exploration Disturbances	none	15.1	15.1
Cumulative Disturbances	6.86 acres	20.6 acres	27.46 acres

Table 7
Soil Suitability Characteristics

Soil Series and Map Symbol	Percent Slope	Erosion Hazard	Seedling Mortality	Plant Competetion	USDA Texture	Coarse Fraction >3 inches (%)	Available Water Capacity (inches/inch of soil)	pH Reaction	SCS Topsoil Suitability Rating
Chesaw	0–45	No Ranking	No Ranking	No Ranking	0–18″ Sandy loam	0–5	0.11–0.12	6.6–7.3	Poor – too stony
CIE					18–60″ Gravelly sand	0–5	0.02–0.03	6.6–7.3	
Colluvial land									
Cu	Variable	No Ranking	No Ranking	No Ranking	No Ranking	No Ranking	No Ranking	No Ranking	No Ranking
Koepke					0–18 Loam	0	0.14–0.18	6.6–7.3	Poor due to slope and coarse fragments
KoD	15–25	Moderate	Slight	Slight to Severe	18–49 Gravelly sandy loam	0	0.09–0.11	6.6–7.3	
KoE	25–45	Severe	Slight	Slight to Severe	49–60 Very gravelly sandy loam	0	0.03–005	8.5–9.0	
Malo	Nearly Level				0–28 Silt loam	0	0.18–0.20	6.6–7.3	Good
Ma		Slight	No Ranking	No Ranking	28–51 Fine sandy loam and sandy loam	0	0.12–0.14	6.6–8.4	
					51–60 Loamy sand	0	0.06–0.08	7.4–7.8	
Mires					0–14 Loam and gravelly loam	0	0.13–0.5	6.6–7.3	Poor due to coarse fragments
Mo		Slight	Slight	Slight	14–26 Gravelly sandy loam	0–5	0.05–0.07	6.6–7.3	
					26–60 Gravelly coarse sand	0–5	0.01–0.03	6.6–7.3	
MolCal									
M+B	0–8	Slight	No Ranking	No Ranking	0–60 Silt loam	–	0.19–0.21	7.9–8.4	Fair to Good
Molson					0–22 Loam or gravelly loam	0–5	0.14–0.16	6.1–7.3	Good if slope is 0 to 8 percent, fair if 8 to 15, poor if more than 15. Poor for MwD, MxE, MyE – too stony and gravelly.
MvC	8–15	Moderate	Slight	Moderate	22–60 Gravelly loam	0–5	0.08–0.11	6.6–8.4	
MxE	25–40	Severe	Moderate	Moderate					
MyE	15–50	No Ranking	No Ranking	No Ranking					
Vallan					Loam in the 40–70 persent of the area not occupied by rock land	2–5	0.12–0.14	6.1–7.3	Poor – Bedrock at 6 to 20 inches
VrE	15–50	Moderate to Very Severe	No Ranking	No Ranking					

Source: Soil Survey of North Ferry Area, Washington (SCS, 1979)

TABLE 8
VISIBILITY OF LAMEFOOT PROJECT AREAS FROM LOCAL TRAVEL ROUTES, RECREATION AREAS, AND RESIDENTIAL AREAS

PROJECT AREA*	VIEWPOINTS			
	STATE HWY 21	COUNTY ROAD 203	CURLEW LAKE STATE PARK	POLLARD
Area A	NV	NV	NV	NV
Area B	NV	NV	NV	NV
Area C	NV	NV	NV	NV
Area D	PV,H	PV,H	NV	NV
Area E	NV	NV	NV	NV
Area F	EV,PV,L→H	EV,PV,L→H	EV,PV,L→H	EV,PV,L→H
Area G	NV	NV	NV	NV
Area H	EV, H	EV,H	EV,H	EV,H

LEGEND

NV = No existing or proposed project disturbance topographically visible
PV = Proposed project disturbance topographically visible
EV = Existing project disturbance topographically visible
L = Low Vegetative Screening
M = Medium Vegetative Screening
H = High Vegetative Screening

*Project Areas are identified on Figure 3

TABLE 9
FERRY COUNTY RESIDENT LABOR FORCE AND EMPLOYMENT BY LABOR AREA

Year	Civilian Labor Force	Employment	Unemployment	Unemployment Rate
1988	2,560	2,200	360	14.1
1986	2,640	2,270	270	14.0
1987	2,650	2,360	290	10.9
1988	2,870	2,540	330	11.5
1989	3,220	2,850	370	11.5
1990	3,280	3,000	280	8.5

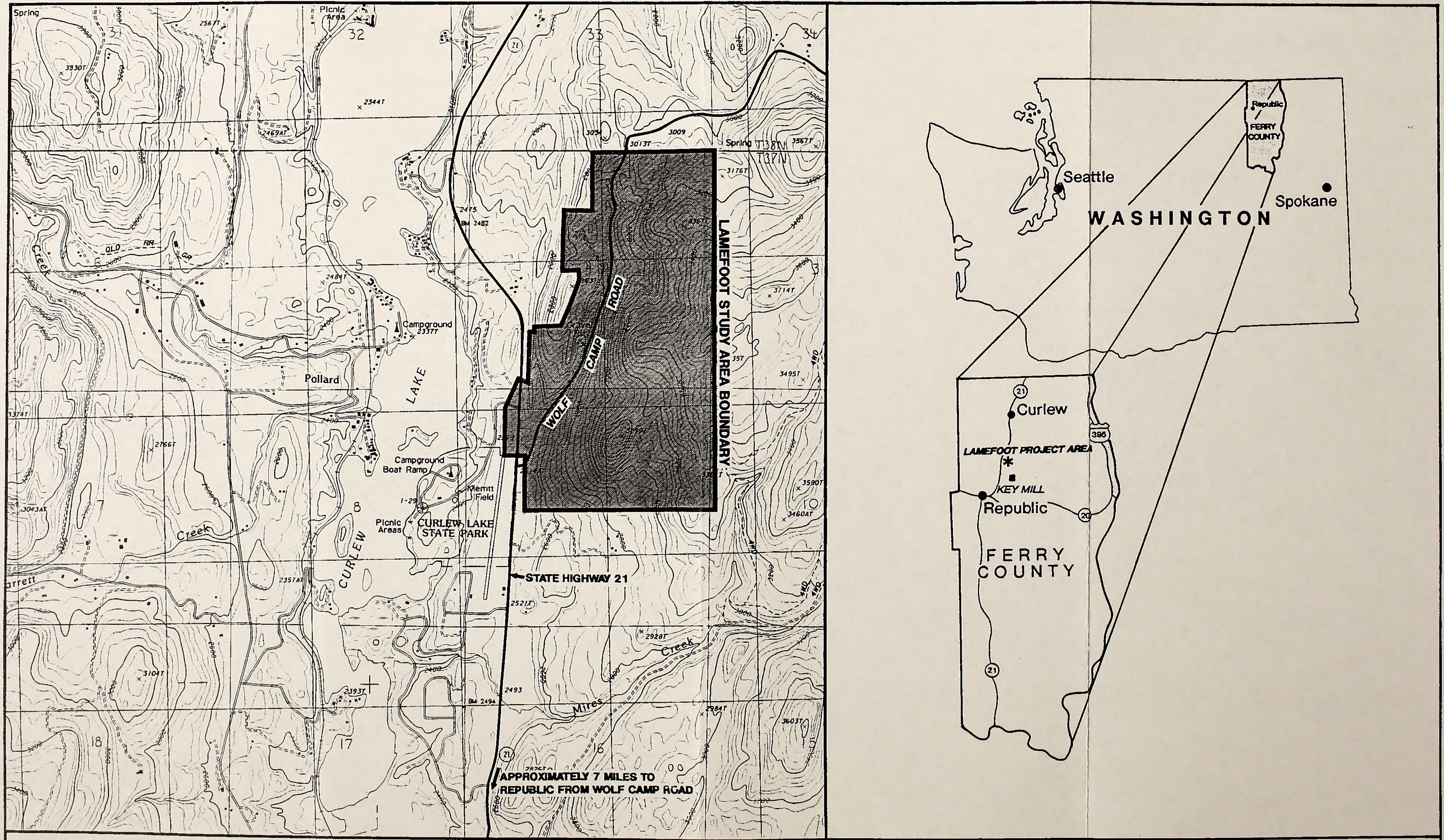
Source: Washington State, Employment Security Department, Labor Market and Economic Analysis Branch.

TABLE 10
FERRY COUNTY AND REPUBLIC POPULATION: 1980-1990

	1980	1985	% Change	1990	% Change
Ferry County	5,811	6,000	3%	6,295	4%
Republic	1,018	N/A	N/A	N/A	N/A

Source: U.S. Department of Commerce, Bureau of the Census, Trico Economic Development District, Planning Information Corporation, August 1991.

Figures



CLIENT/PROJECT

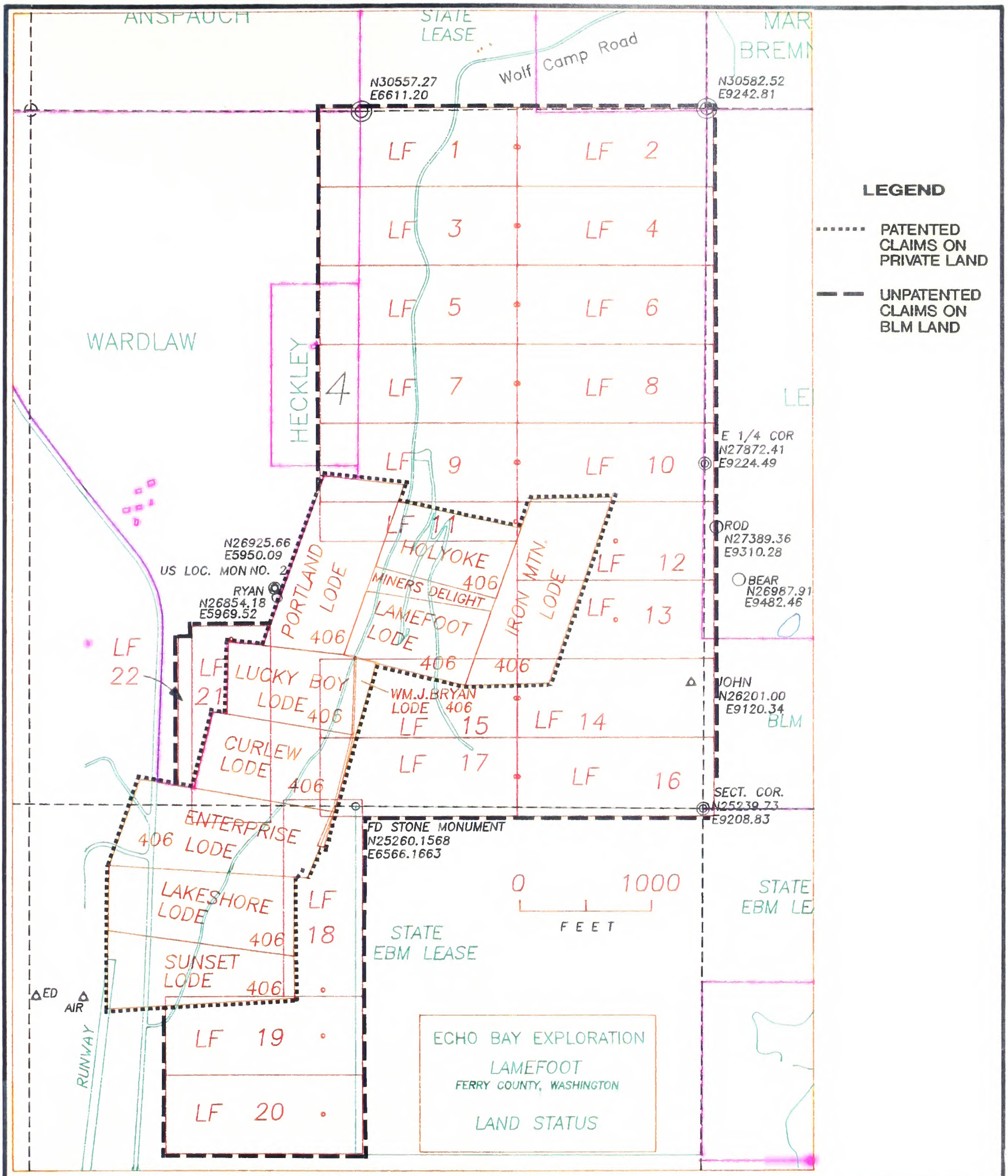
ECHO BAY EXPLORATION, INC.
LAMEFOOT PROJECT

Golder Associates Inc.
Denver, Colorado

TITLE

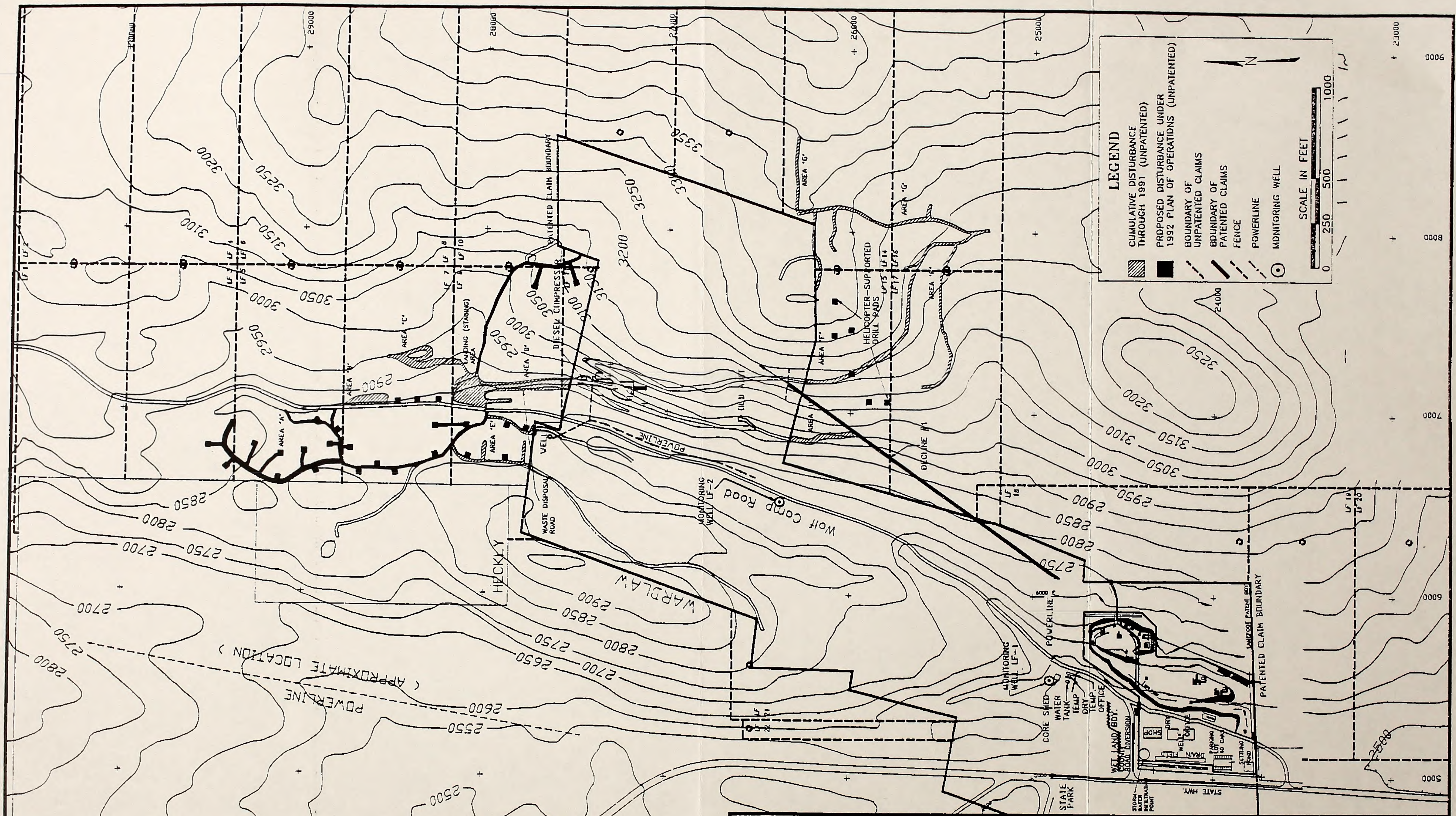
GENERAL LOCATION, ACCESS, AND TOPOGRAPHY MAP OF LAMEFOOT STUDY AREA

DRAWN KAW	CHECKED JK	REVIEWED JT	DATE MARCH 1992	SCALE 1"=2000'	JOB NO. 913-2370	FILE	DWG. NO.	FIGURE 1



Golder Associates Inc.
Denver, Colorado

CLIENT/PROJECT ECHO BAY EXPLORATION, INC. LAMEFOOT PROJECT		TITLE LAND STATUS IN LAMEFOOT STUDY AREA	
DRAWN ECHO BAY	CHECKED JK	REVIEWED JT	DATE MARCH 1992
SCALE AS SHOWN	JOB NO. 913-2370	FILE	DWG. NO.
FIGURE 2			

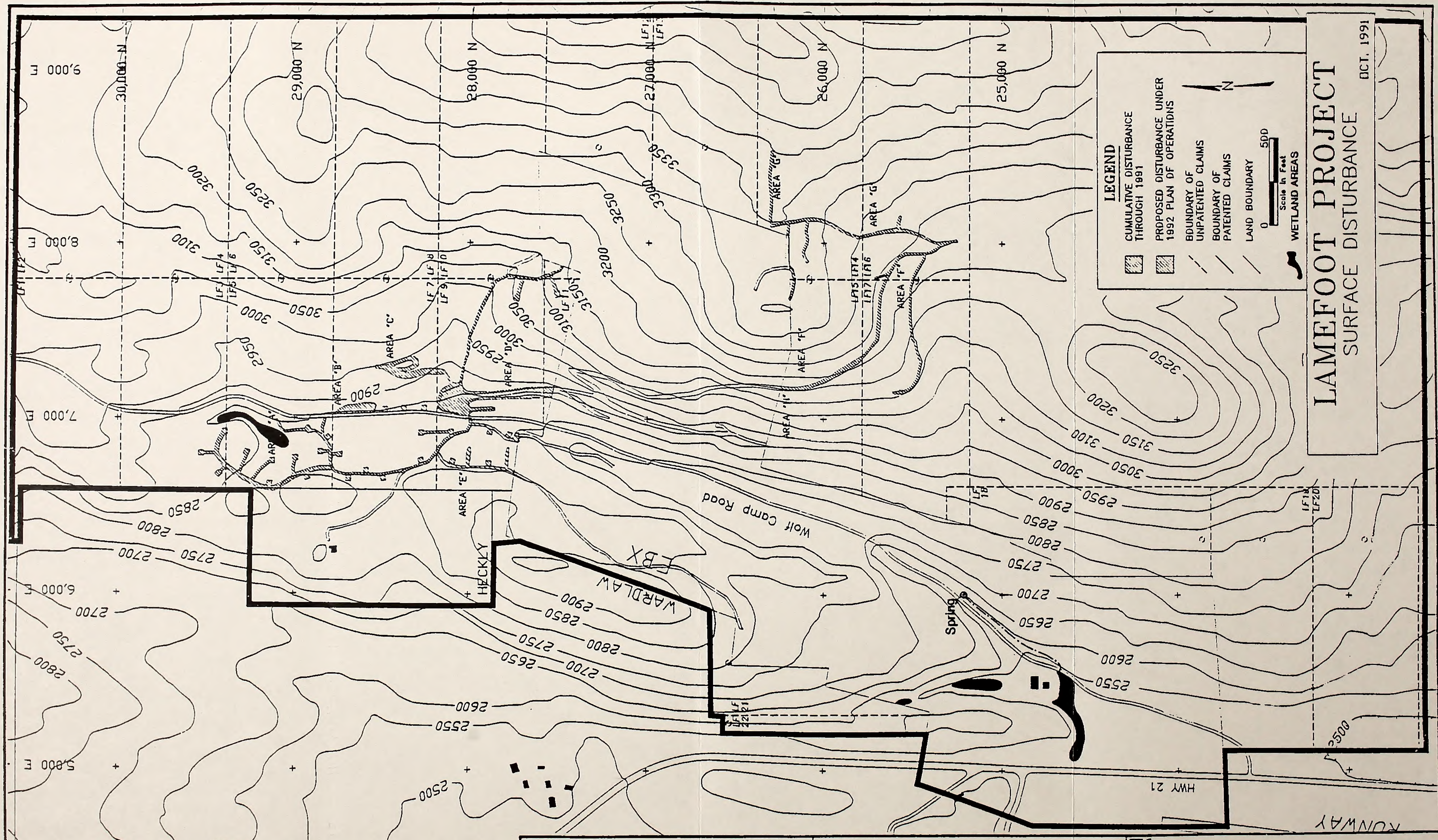


Golder Associates
Denver, Colorado

CLIENT/PROJECT
ECHO BAY EXPLORATION, INC.
LAMEFOOT PROJECT

TITLE
CUMULATIVE DISTURBANCE MAP
FOR PATENTED/UNPATENTED
LAMEFOOT CLAIMS

DRAWN	KAW	DATE	MARCH 1992	JOB NO.	913-2370
CHECKED	VE	SCALE	AS SHOWN	DWG. NO./REV. NO.	
REVIEWED	JK	FILE NO.	DISTURB	FIGURE NO.	3

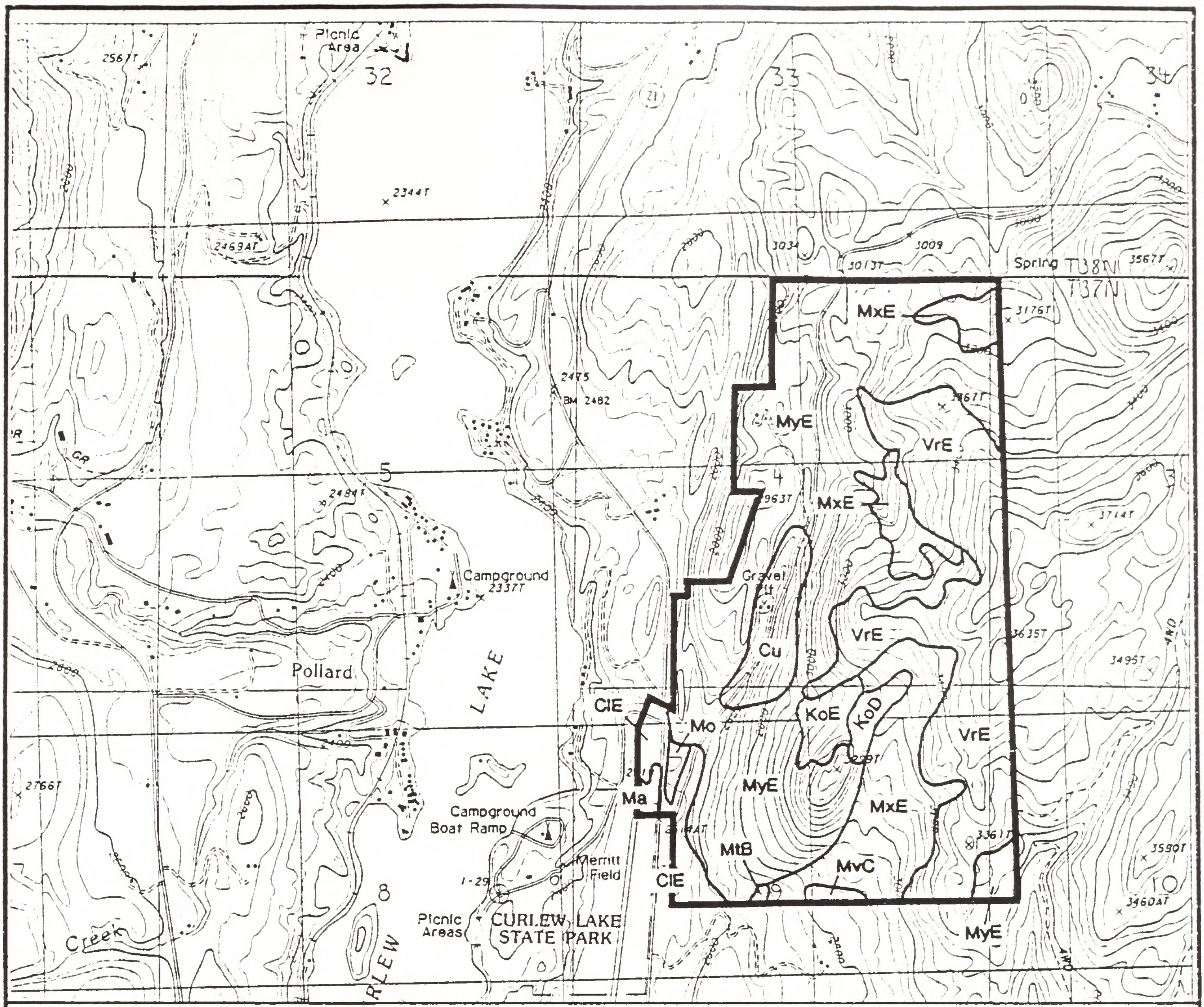


CLIENT/PROJECT
ECHO BAY EXPLORATION, INC.
LAMEFOOT PROJECT

Golder Associates Inc.
Denver, Colorado

TITLE
WETLANDS MAP

DRAWN	CHECKED	REVIEWED	DATE	SCALE	JOB NO.	FILE	DWG. NO.	FIGURE
MLW	JK	JT	MAY 1992	AS SHOWN	923-2450			4



SOIL TYPES

CIE	Chesaw stony sandy loam, 0 to 45 percent slopes
Cu	Colluvial land
KoD	Koepke loam, 15 to 25 percent slopes
KoE	Koepke loam, 25 to 45 percent slopes
Ma	Malo silt loam
Mo	Miras loam
MtB	Molcal silt loam, 0 to 8 percent slopes
MvC	Molson loam, 8 to 15 percent slopes
MxE	Molson stony loam, 25 to 40 percent slopes
MyE	Molson rock land complex, 15 to 50 percent slopes
VrE	Vallan rock land complex, 15 to 50 percent slopes

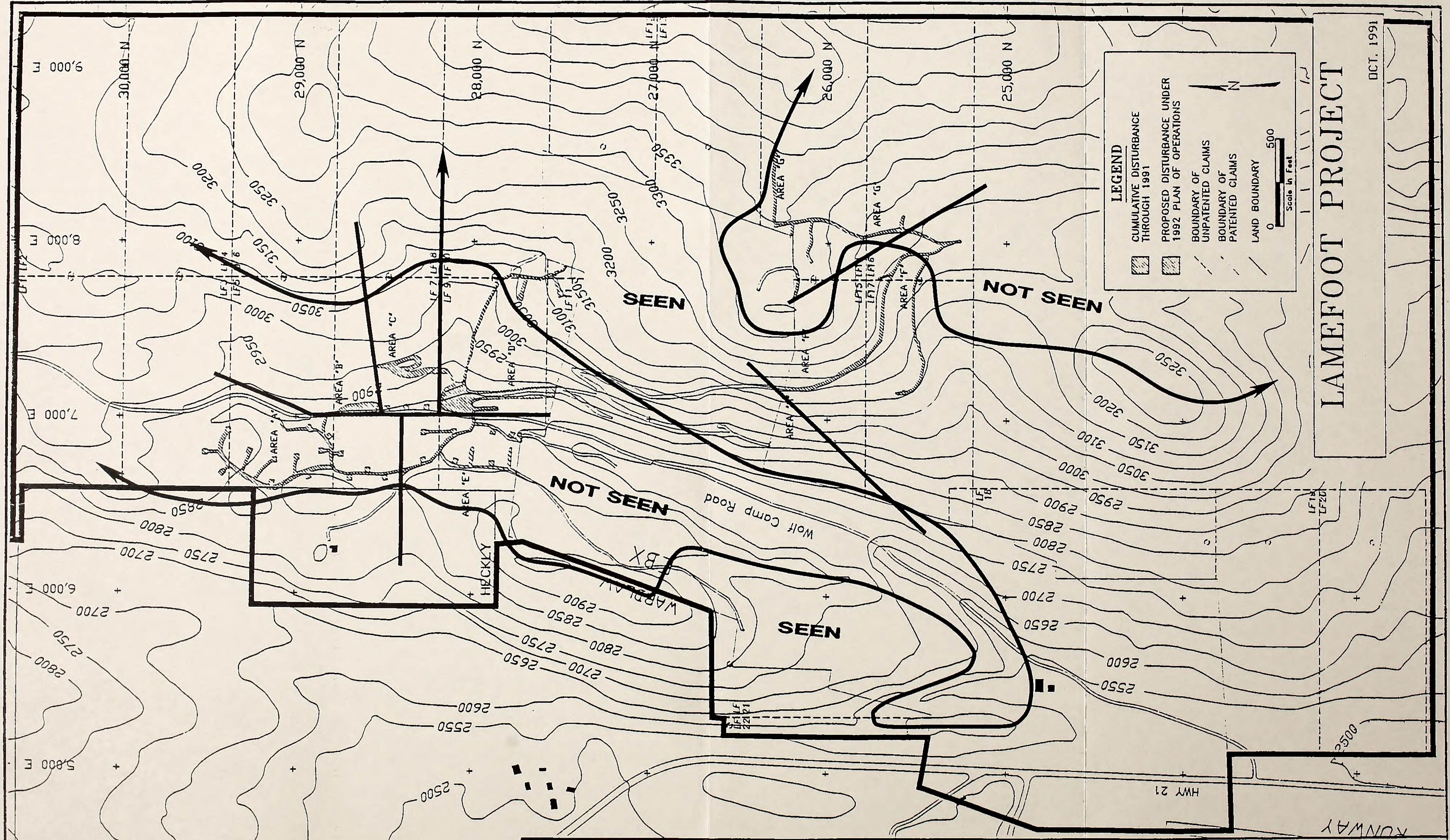
Golder Associates Inc.
Denver, Colorado

CLIENT/PROJECT
ECHO BAY EXPLORATION, INC.
LAMEFOOT PROJECT

TITLE
SOILS MAP

DATE MAY 1992	SCALE 1"=2000'	JOB NO. 923-2450
FILE	DWG. NO.	FIGURE 5

DRAWN BDL
CHECKED JK
REVIEWED JT



CLIENT/PROJECT
ECHO BAY EXPLORATION, INC.
LAMEFOOT PROJECT

Golder Associates Inc.
Denver, Colorado

TITLE
APPROXIMATE TOPOGRAPHIC VISIBILITY OF LAMEFOOT STUDY AREA RELATIVE TO LOCAL VIEWPOINTS

DRAWN	CHECKED	REVIEWED	DATE	SCALE	JOB NO.	FILE	DWG.NO.	FIGURE
COL	JK	JT	MAY 1992	AS SHOWN	923-2450			6

Appendix A

APPENDIX A

ANALYTICAL RESULTS FROM GROUNDWATER WELLS LF-1 AND LF-2

REPORT OF ANALYTICAL RESULTS

Client :ECHO BAY	SVL Job Number :11043
Client Sample ID :LF-1	SVL Sample ID :14989
Date of Sample Receipt :10/22/91	Matrix :WA
Date of Report :11/08/91	

Determination	Result	Units	Method	Reference
Cation-Anion Bal	+8.9	mg/L		
Spec. Cond.	696.0	-	120.1	1
Hardness	502.7	mg/L	130.2	1
pH-Water	7.63	-	150.1	1
TDS	606.0	mg/L	160.1	1
TSS	12.4	mg/L	160.2	1
Aluminum-Diss	<0.019	mg/L	200.7	1
Arsenic-Dissolve	<0.049	mg/L	200.7	1
Boron-Dis	<0.031	mg/L	200.7	1
Calcium-Diss	141.3	mg/L	200.7	1
Cadmium-Diss.	<0.002	mg/L	200.7	1
Copper-Dissolved	0.006	mg/L	200.7	1
Iron-Diss	<0.011	mg/L	200.7	1
Potassium-Diss	2.62	mg/L	200.7	1
Magnesium-Diss	36.4	mg/L	200.7	1
Manganese-Diss	0.013	mg/L	200.7	1
Molybedenium-Dis	<0.010	mg/L	200.7	1
Sodium-Dissolved	10.5	mg/L	200.7	1
Nickel-Dissolved	<0.014	mg/L	200.7	1
Pb-Dis	<0.031	mg/L	200.7	1
Selenium-Diss	<0.055	mg/L	200.7	1
Zn-Dis	0.007	mg/L	200.7	1
Hg-Dissolved	<0.0002	mg/L	245.2	1
Chloride	2.07	mg/L	300.0	1
Flouride	0.38	mg/L	300.0	1
Sulfate	224.6	mg/L	300.0	1
Cyanide	<0.01	mg/L	335.2	1
Nitrite asN	<0.01	mg/L	353.2	1
NO2NO3-N	0.47	mg/L	353.2	1
Nitrate-N	0.47	mg/L	353.2	1
Phosphate-Or-Dis	0.03	mg/L	365.2	1

REPORT OF ANALYTICAL RESULTS

Client	:ECHO BAY	SVL Job Number	:11043
Client Sample ID	:LF-1	SVL Sample ID	:14989
Date of Sample Receipt	:10/22/91	Matrix	:WA
Date of Report	:11/08/91		

Determination	Result	Units	Method	Reference
Alkalinity	248.0	mg/L	403	3
Calcium Carb.	0.0	mg/L	403	3
Bicarbonate	248.0	mg/L	403	

REPORT OF ANALYTICAL RESULTS

Client :ECHO BAY
Client Sample ID :LF-2
Date of Sample Receipt :10/22/91
Date of Report :11/08/91

SVL Job Number :11043
SVL Sample ID :14990
Matrix :WA

Determination	Result	Units	Method	Reference
Cation-Anion Bal		mg/L		
Hardness	597.4	mg/L	130.2	1
pH-Water	7.47	-	150.1	1
TDS	705.0	mg/L	160.1	1
TSS	4.8	mg/L	160.2	1
Aluminum-Diss	0.026	mg/L	200.7	1
Arsenic-Dissolve	<0.044	mg/L	200.7	1
Boron-Dis	0.033	mg/L	200.7	1
Calcium-Diss	163.7	mg/L	200.7	1
Cadmium-Diss.	<0.002	mg/L	200.7	1
Copper-Dissolved	0.005	mg/L	200.7	1
Iron-Diss	0.013	mg/L	200.7	1
Potassium-Diss	2.70	mg/L	200.7	1
Magnesium-Diss	45.8	mg/L	200.7	1
Manganese-Diss	0.006	mg/L	200.7	1
Molybedenium-Dis	<0.010	mg/L	200.7	1
Sodium-Dissolved	12.2	mg/L	200.7	1
Nickel-Dissolved	<0.014	mg/L	200.7	1
Pb-Dis	<0.031	mg/L	200.7	1
Selenium-Diss	<0.055	mg/L	200.7	1
Zn-Dis	0.023	mg/L	200.7	1
Hg-Dissolved	0.0002	mg/L	245.2	1
Chloride	2.40	mg/L	300.0	1
Flouride	0.48	mg/L	300.0	1
Sulfate	253.8	mg/L	300.0	1
Cyanide	<0.01	mg/L	335.2	1
Nitrite asN	<0.01	mg/L	353.2	1
NO2NO3-N	0.21	mg/L	353.2	1
Nitrate-N	0.21	mg/L	353.2	1
Phosphate-Or-Dis	<0.01	mg/L	365.2	1
Alkalinity	314.0	mg/L	403	3

REPORT OF ANALYTICAL RESULTS

Client :ECHO BAY
Client Sample ID :LF-2
Date of Sample Receipt :10/22/91
Date of Report :11/08/91

SVL Job Number :11043
SVL Sample ID :14990
Matrix :WA

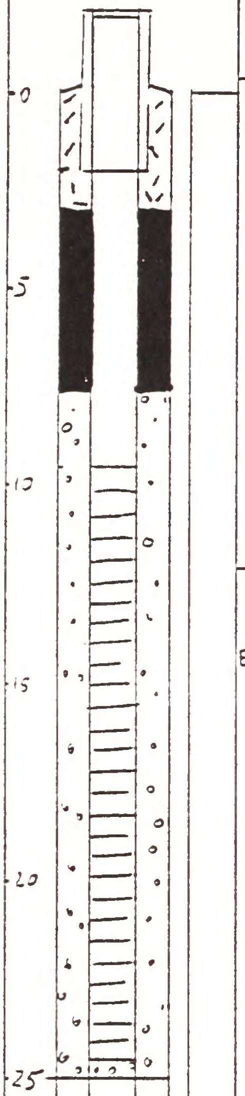
Determination	Result	Units	Method	Reference
Calcium Carb.	0.0	mg/L	403	3
Bicarbonate	314.0	mg/L	403	

Well No. LF-1
Boring No. X-Ref: LF-1

MONITORING WELL CONSTRUCTION SUMMARY

Survey Coords: Northing: 0 ft.
Easting: 0 ft.

Elevation Ground Level ~2560.0 ft.
Top of PVC Casing



Drilling Summary:

Total Depth 25.0 ft.
Borehole Diameter 6.63 in.
Casing Stickup Height 3.00 ft.
Driller Ruen Drilling
Clarkfork, Idaho
W. Hayes/S. Wycoff
Rig Schramm Rotadrill TH64
Bit(s) 6-inch Tri-cone

Drilling Fluid Potable Water

Protective Casing 6-5/8 inch O.D. Black
Steel Pipe

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
8 inch bit	10-17-91	08:15	10-17-91	10:10
Geophys.Logging:				
Casing:				
2 inch PVC	10-17-91	10:10	10-17-91	10:40
Filter Placement:	10-17-91	10:40	10-17-91	11:15
Grouting:	10-17-91	11:15	10-17-91	12:00
Development	10-18-91	12:20	10-13-91	13:10

Well Design & Specifications

Basis: Geologic Log ___ Geophysical Log ___
Casing string(s): C = Casing S = Screen

Depth	String(s)	Elevation
+ 3.0 - 9.5	C1	-
9.5 - 24.5	S1	-

Casing: C1 2 inch Schedule 40 PVC

Screen: S1 2 inch Triloc, 0.020 inch slot

Filter Pack: #10-#20 Silica sand pack
from 7.5 to 25.0 ft.

Grout Seal: Concrete from surface to 3.0 ft.

Bentonite Seal: 3/8 inch bentonite chips from
3.0 to 7.5 ft.

Well Development

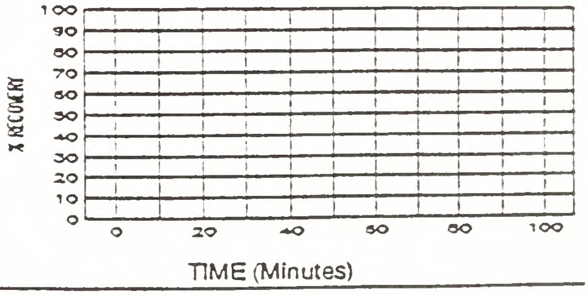
Developed for 50 minutes using submersible Grundfus Pump - 65 gallons removed

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)
1248	7.44	875	--
1252	7.50	896	--
1255	7.51	888	--
1300	7.48	867	--
1304	7.50	887	--

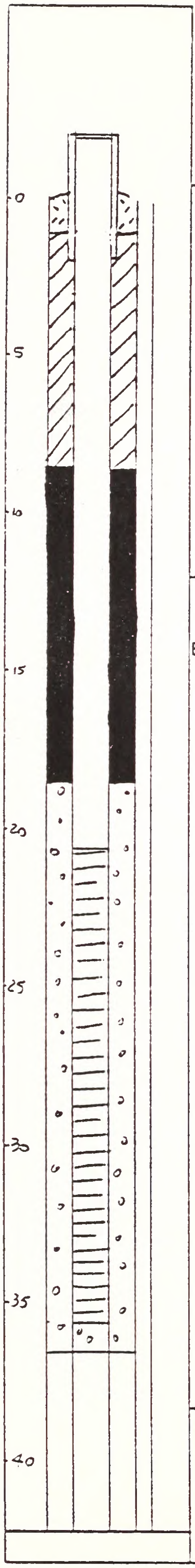
Recovery Data:

Q= So=



Comments:

Supervised by B. TILTON
Jobnumber 913-2370
Site LAMEFOOT
Filename 2370LF1



Well No. LF-2
Boring No. X-Ref: LF-2

MONITORING WELL CONSTRUCTION SUMMARY

Survey Coords: Northing: 0 ft.
Easting: 0 ft.

Elevation Ground Level ~2640.0 ft.
Top of PVC Casing

Drilling Summary:

Total Depth 36.0 ft.
Borehole Diameter 6.63 in.
Casing Stickup Height 3.20 ft.
Driller Ruen Drilling
Clarkfork, Idano
W. Hayes/S. Wycoff
Rig Schramm Rotadrill TH64
Bit(s) 6-inch Tri-cone
Drilling Fluid Potable Water
Protective Casing 6-5/8 inch O.D. Black Steel Pipe

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
8 inch bit	10-17-91	13:15	10-17-91	15:30
Geophys.Logging:				
Casing:				
2 inch PVC	10-17-91	15:30	10-17-91	16:00
Filter Placement:	10-17-91	16:00	10-17-91	17:00
Grouting:	10-18-91	08:00	10-18-91	10:15
Development	10-18-91	11:00	10-18-91	11:45

Well Design & Specifications

Basis: Geologic Log ___ Geophysical Log ___
Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation	
+ 3.2	-	20.5	C1		-
20.5	-	35.5	S1		-

Casing: C1 2 inch Schedule 40 PVC

Screen: S1 2 inch Triloc, 0.020 inch slot

Filter Pack: #10-#20 Silica sand pack from 18.5 to 35.5 ft.

Grout Seal: Portland Cement with 5% bentonite from 1.0 to 8.5 ft.

Bentonite Seal: 3/8 inch bentonite chips from 8.5 to 18.5 ft.

Well Development

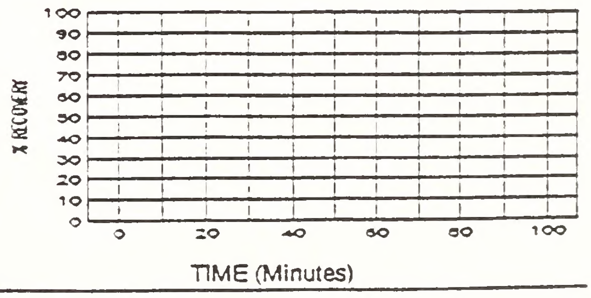
Developed for 45 minutes using submersible Grundfus Pump - 65 gallons removed

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)
1122	7.20	1033	--
1126	7.28	1002	--
1130	7.30	1031	--
1134	7.28	1009	--
1140	7.26	986	--

Recovery Data:

Q= So=



Comments:

Supervised by B. TILTON
Jobnumber 913-2370
Site LAMEFOOT
Filename 2370LF2

Appendix B

APPENDIX B

WILDLIFE INFORMATION FROM THE WASHINGTON NATURAL HERITAGE PROGRAM

CURT SMITCH
Director

STATE OF WASHINGTON
DEPARTMENT OF WILDLIFE
600 Capitol Way North • Olympia, Washington 98501-1091 • (206) 753-5700

FAX TRANSMISSION

To:

Lynn Sharp
Environmental Consultant
10406 S.E. 54th Place
Milwaukie, OR 97222

From:

Carmen Andonaegui
Nongame Data Systems
Olympia, WA
ph (206) 586-1449

Date/Time:

March 4, 1992
11:30 AM

Note:

Lynn,
Just finished this today when Tom said you called. Any questions, give me a call.

Carmen

NONGAME DATA SYSTEMS FAX #493-9497

TOTAL PAGES: (Including cover) 2

RE: SPECIES OF CONCERN - PROJECT FOR LYNN SHARP, CONSULTANT

Quad Name	T R S	Conf.	---Status---		Element Name	Crit.	Occ.
			Fed.	State			
REPUBLIC 15 4811866	37N 33E 05	G		SM	Podiceps grisegena Red-necked grebe	B	26 -1
REPUBLIC 15 4811866	37N 33E 08	C		SM	Ardea herodias Great blue heron	B	30 -1

Appendix C

APPENDIX C

LAMEFOOT PROJECT CULTURAL RESOURCES REPORTS

A Cultural Resources Survey on Federal Lands in the Lame Foot Project Area, Ferry County, Washington

by

Craig Holstine
Principal Investigator

I wrote this.
Craig Holstine

Short Report 292
Archaeological and Historical Services
Eastern Washington University

January 1992

Introduction

Echo Bay Exploration Inc. is conducting exploratory drilling for marketable ores in the hills east of Curlew Lake in northern Ferry County, Washington. Situated approximately 8 miles northeast of the city of Republic, the project area includes federal, state and private lands (Figure 1). Test drilling has been underway for some time on both patented (privately owned) and unpatented (publicly owned) mining claims. Echo Bay Exploration Inc. has recently acquired ownership of numerous unpatented claims in the vicinity, one of which was historically known as Lame Foot. Once the company renamed all the claims by that appellation and appended a number (e.g., Lame Foot 1) to each, the exploratory activity became known as the Lame Foot project.

Project Area

Situated in Secs. 4 and 9, T37N, R33E and Sec. 33, T38N, R33E, the project area consists of steeply wooded mountains rising east of Curlew Lake. Elevations within the project area measure from just over 2500 feet nearest (ca. 0.2 mile) to the lake to 3600 feet at the eastern edge of the property. Grasses and forest duff cover most of the ground surface, with frequent occurrences of rock outcrops. Numerous disturbances, primarily caused by logging, road construction, prospecting/mining, and test drilling, have affected the area.

Cultural Resource Survey

On behalf of Echo Bay Exploration Inc., Archaeological and Historical Services (AHS) conducted a survey for cultural resources on federal lands within the project area. Those properties consisted of several unpatented mining claims scheduled for, or presently undergoing, test drilling. All of the unpatented claims are currently owned by the Bureau of Land Management (BLM).

The survey was conducted on areas under, or scheduled for, development as follows:

W 1/2 NE and SW SE Sec. 4, T37N, R33E

S 1/2 N 1/2 Sec. 9, T37N, R33E

Five historic mining prospects were observed during the survey. The prospects range from simple pits to collapsed adits and shafts. Waste rock piles adjacent to the prospects are small, indicating minimal amounts of development. No cultural resources were observed in the vicinities, again an indication of short-lived activity. Being of limited cultural value (i.e., not likely to yield important information), the prospects were described in survey notes but not formally recorded with state inventory numbers. No materials nor features associated with

aboriginal peoples were observed during the survey, and none is likely to exist in the areas surveyed. Table 1 below summarizes the prospects observed and their locations. The modern or present claim on which they are situated is followed by what is believed to have been the historic or original claim covering that location. Present claims do not match the configuration of original claims. Locations and boundaries of the latter claims were estimated for the present project, as no map of unpatented claims dating to the early historic period in the area is known to exist. Spellings of claims and claimants appear in the table as spelled in the Ferry County Auditor's records (*Quartz Record, Book C*, pp. 34-35 and *Book F*, pp. 13, 465, and 493-94).

Table 1: Cultural Features Observed during the Survey

Feature	Location	Modern Claim	Historic Claim	Historic Claimant	Date
adit & shaft	NW SW NE Sec. 4	Lame Foot 5	Black Diamond(?)	O.B. Nelson	3/12/96
prospect pits	NW SW NE Sec. 4	Lame Foot 5	Omaha	Thomas D. Fuller & James Krenk	9/17/1896
prospect pit	SW SW NE Sec. 4	Lame Foot 7	Omaha	T.D.Fuller James Krenk	9/17/1896
adit & 2 shafts	SW SW SE Sec. 4	Lame Foot 17	Nika Tillikom	Dodie Murry	4/23/1896
shaft	SW SW NE Sec. 9	Lame Foot 20	Nadjy	Alexander M. Reynolds	2/11/1896

Previous Cultural Resource Identification

Over a dozen cultural resource sites have been recorded on the shores and islands of Curlew Lake, located less than 1 mile west of the project area. For the most part, the sites appear to be the remains of aboriginal campsites and burials. Forms recording those sites are maintained in the Washington State Office of Archaeology and Historic Preservation (OAHP) in Olympia. OAHP site files contain no historic or prehistoric sites in or adjacent to the Lame Foot project area.

Project Area Background

Ethnographically, the project area lies within the traditional territories of at least two Interior Salish groups: the Sanpoil-Nespelems and the Lakes Indians (Ray 1933 and 1936). Ray deliberately avoids drawing precise boundary lines between traditional territories, particularly inland from the Columbia River: "All villages were located along the Columbia river; therefore the boundary points on the river were much more clearly defined than in other parts of the territory" (1933:13). He notes that the nearest Sanpoil Indian temporary campsite to the project area was located at the Republic townsite (1933:21). Regarding temporary camps of the Sanpoil-Nespelem, Ray (1933:20) maintained:

> These are not properly termed villages, for although each was in use more or less constantly throughout the summer, and to some extent during the winter, the occupancy was never stable. The camps were used principally by groups travelling up the river on hunting, fishing or berrying expeditions. A given party would stop at one camp for a few days, then move on to the next or perhaps to one a day's journey distant.

The nearest Lakes Indian village site was reportedly situated at Malo ca. 4 miles northeast of Curlew Lake (Ray 1936:28).

While Indians tended to concentrate in large numbers at summer fisheries and winter village sites along the Columbia River, aboriginal inhabitants in dispersed groups utilized the higher, mountainous country of the Okanogan Highlands seasonally for hunting and gathering purposes. Valleys with sufficient water supplies, such as Curlew Lake, attracted at least temporary occupation, while surrounding mountains provided hunting grounds, root and berry resources, and, on prominent peaks and ridges, vision quest sites. Given its relatively steep terrain and forested environment, the project area was most likely utilized for resource procurement and not for occupation by aboriginal peoples.

The first activity of any significance by whites in the area was associated with hard rock mining. Following the opening of the "North Half" of the Colville Indian Reservation to mining in 1896, prospectors combed the countryside of what is today northern Ferry County in search of ore-bearing deposits. The Curlew Lake area originally fell within the Republic Mining District, but after 1906 was included within the Belcher Mining District, named for the mine on Cooke Mountain that produced ores until the World War I era. The Belcher appears to have been the only profitable mine in the District (Bancroft 1914:166-79).

Early in 1896, miners filed claims on properties in or near the project area. One of the earliest in the vicinity was George Wolf, for whom Wolf Camp Road (which crosses the project area) is probably named. On 19 March 1896 he located the Portland Lode claim, and with J.W. McCann filed on the Iron Mountain Lode that spring as well (*Quartz Record, Book D*, pp. 78, 94-95). Those claims, along with the Lame Foot, Miner's Delight, Holyoke, Lucky Boy, Curlew, Enterprise, Lake Shore, Sunset, and William J. Bryan, were sold later that year to Jacob Goetz and Harry F. Baer (*Mining Deeds, Vol. B*, pp. 74-75, 115-118). In January and

February 1898, Thomas M. Hammond, Jr., U.S. Deputy Mineral Surveyor, surveyed the claims as Mineral Survey No. 406 (Bureau of Land Management). Jacob Goetz and Co. were then issued Patent No. 30865 on 4 April 1899 and the property was transferred from the public domain to private ownership (*Patent Book 1*, pp. 41-45). The patented claims comprise the bulk of private property within the Lame Foot project area and were not surveyed for the present study.

Jacob Goetz and Harry Baer are notable figures in the history of the so-called Inland Empire. Having made a small fortune in the Coeur d'Alene mines, they arrived in Spokane Falls in the late 1880s and invested their wealth in a hotel, which was subsequently lost in the city's great fire of 1889. The partners recovered financially from their losses by opening a hotel and gambling establishment in Spokane that came to be known as the Coeur d'Alene Hotel. "Dutch Jake," as Goetz was known, became one of the more colorful figures in the city (Fargo 1950:168-76). Goetz and Baer apparently employed their mining and business skills in speculation in the mining properties of Ferry County.

It is not known how profitable their holdings within the present project area were to the entrepreneurs. When the survey of the Goetz Co. claims was done in 1898, numerous shafts, tunnels, and "open cuts" existed on the property, as did a log house and an air compressor (Bureau of Land Management). Other claims surrounding Mineral Survey 406 remained unpatented and do not appear to have experienced any serious development. The prospects evaluated for the present study are located on several of those unpatented claims in the project area.

Conclusions and Recommendations

None of the prospects observed during survey of the present project area appears eligible for inclusion in the National Register of Historic Places. No historically significant persons nor events are known to have been associated with the properties (National Register Criteria A and B, 36 CFR 60.4); the prospects do not bear structural integrity (Criterion C); nor do the features appear likely to yield important historical information (Criterion D). Without other cultural materials, the properties lack the ability to answer meaningful research questions that would add to an understanding of late nineteenth/early twentieth century mining in the region. The prospects are not unlike thousands of other similar features found throughout the American West. Others bear more integrity and are associated with more extensive mining complexes with demonstrated historical and economic significance.

It is recommended that this report be submitted to the appropriate agencies for review before proceeding further with project.

References

Bancroft, Howland

1914 *The Ore Deposits of Northeastern Washington.* U.S. Geological Survey *Bulletin 550.* Government Printing Office, Washington, D.C.

Bureau of Land Management

1898 Plat of the Claim of Jacob Goetz and Co. Mineral Survey 406. Approved by the Surveyor General's Office, 15 April.

Code of Federal Regulations

n.d. National Register of Historic Places Criteria for Evaluation. Vol. 36, Part 60.4. Government Printing Office, Washington, D.C.

Fargo, Lucile F.

1950 *Spokane Story: A Colorful Early History of the Capital City of the Inland Empire.* Published under the sponsorship of the Eastern Washington State Historical Society by The Northwestern Press, Minneapolis, Minnesota.

Ferry County Auditor

n.d. *Mining Deeds, Vol. B.* Ferry County Courthouse, Republic, Washington.

n.d. *Patent Book 1.* Ferry County Courthouse.

n.d. *Quartz Record, Books C, D, and F.* Ferry County Courthouse.

Ray, Verne F.

1933 *The Sanpoil and Nespelem, Salishan Peoples of Northeastern Washington.* University of Washington Press, Seattle. Reprinted by Human Relations Area Files, New Haven 1954.

1936 "Native Villages and Groupings of the Columbia Basin." *Pacific Northwest Quarterly* 27:99-152.

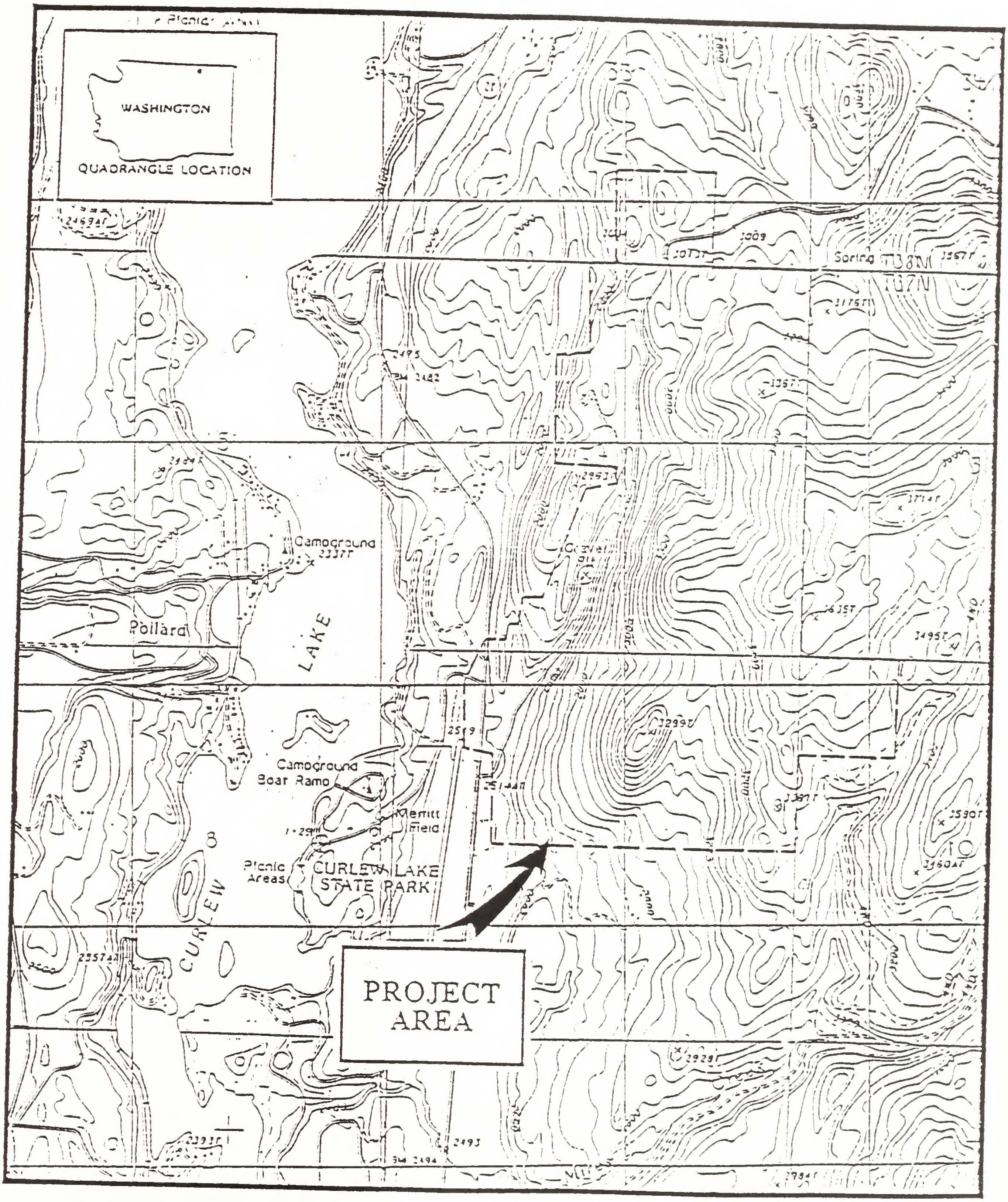


Figure 1. Lame Foot project area.

A Cultural Resources Survey on Private Lands in the Lamefoot Project Area, Ferry County, Washington

By Craig Holstine

I wrote this.
Craig Holstine

Short Report 301
Archaeological and Historical Services
Eastern Washington University

May 1992

Introduction

Echo Bay Minerals, Inc., is conducting exploratory drilling for marketable ores on federal, state and private lands east of Curlew Lake in northern Ferry County, Washington (Figure 1). Test drilling is underway on both patented (privately owned) and unpatented (publicly owned) mining claims to obtain information regarding mineralization on the claims, known collectively as the Lamefoot Project. In addition to drilling, construction of two exploration portals on private lands within the project area (see Figure 2) is proposed. Should the results of the explorations be favorable, the project may be developed as a mine for commercial purposes (Golder Associates and Echo Bay Minerals 1992).

Cultural Resource Survey

At the request of Echo Bay Exploration, Inc., Archaeological and Historical Services (AHS) conducted a cultural resources survey on selected portions of federal lands scheduled for development in the project area (Holstine 1992). Subsequent to the initial survey involving only public lands, the Bureau of Land Management (BLM) suggested that a similar survey be performed on portions of privately owned property within the project area. Echo Bay Minerals then requested that AHS survey approximately 30 acres of private land on which disturbances associated with construction of the exploration portals will occur (see Figure 2). The latter survey was done in two separate locales: the Lower Area, in NW Sec. 9, T37N, R33E; and the Upper Area, in S 1/2 Sec. 4, T37N, R33E. In addition to surveying the areas scheduled for disturbance, AHS also located and examined the sites of historic structures appearing on a historic map of Mineral Survey 406 (US Surveyor General 1898). The historic resources are also located in Secs. 4 and 9.

Survey of the Lower Area

Wolf Camp Road bisects the Lower Area, which lies immediately east of State Highway 21 north of its junction with Wolf Camp Road. Low grasses cover the flat between the road and the highway; pine and other coniferous trees grow on the hillside to the east within the Lower Area. The lack of thick vegetation and many rodent burrows provided excellent ground visibility on the flat, which was inspected by ground survey in its entirety; logging was underway on the hillside to the east during the survey, creating considerable disturbance to a landform unlikely to contain cultural resources. Representative locales on the hillside were surveyed. No cultural resources were observed there or on the flat.

A small stream crosses the upper (north) edge of the Lower Area across the site of what is labeled on the Mineral Survey map as a "Log House" (US Surveyor General 1898). No remains of the house were observed during the survey. Immediately northeast of the site of the "Log House," coniferous trees grow thick along the stream and eastward to Wolf Camp Road. Along the road stand a modern garage and pumphouse associated with the current exploratory drilling.

At that location a group of structures once stood known as "Wolf Camp" (Hilderbrant 1992). No trace of the buildings was observed during the survey.

Survey of the Upper Area

The Upper Area slated for development lies, for the most part, on the steep west-facing slope above Wolf Camp Road, with a smaller portion situated in the in the canyon bottom and on the east-facing slope rising abruptly on the west side of the canyon. Below Wolf Camp Road to the west, the bottom of the canyon has been completely disturbed by bulldozing. The hillside to the west is extremely steep not a landform likely to contain cultural resources. Roads and impacts related to exploratory drilling have affected much of the hillside to the east, which is also extremely steep and highly unlikely to contain cultural resources, with the exception of the several historic-era prospect pits observed during the survey. Of the six prospect pits observed above (east of) the drill access road, only one of the pits is greater than 5 meters in diameter. That pit, located ca. 10 meters east of Station N 77700, E 7101, is ca. 10 meters in diameter. Small waste rock piles lie near all the pits, but no cultural resources were observed in close proximity to the prospect features. Presumably mining activities associated with the pits was short lived and left little or no cultural materials behind.

Cultural Resources Observed on Private Lands Not within the Upper or Lower Areas

Adit: Situated on the hillside high above (east of) Wolf Camp Road in W 1/2 W 1/2 SE Sec. 4, T37N, R33E, an adit enters solid rock above a recently graded drilling access road. The adit appears on the Mineral Survey map (US Surveyor General 1898) as "Imp. [Improvement] No. 2 Tunnel" on the Lame Foot (sic) Lode claim. Its portal is ca. 7 feet high and 5 feet wide; wooden ties from an ore car track whose rails have been removed extend into the adit. Reportedly the adit crossed through a structural zone of sulfides and magnetites containing gold. But it does not appear to have been a large producer of profitable ores, however.

Air Compressor Building Remains: Concrete machinery pads and scattered boards and metal fragments are all that remain of what is show on the Mineral Survey map (US Surveyor General 1898) as "Imp. No. 2 Air Compressor" on the Portland Lode claim. Situated in the canyon bottom below (west of) Wolf Camp Road and adjacent to (east of) an old road up the valley floor, the two concrete pads measure ca. 4 X 7 feet and ca. 2 X 7 feet. Both are ca. 18 inches high and have rusted, threaded metal 1 inch thick bolts protruding from their tops. Deteriorated boards and planks with wire nails lie strewn about the pads. The remains are located in the E 1/2 E 1/2 SW Sec. 4, T37N, R33E.

Brief History of Mineral Survey No. 406

George Wolf, for whom Wolf Camp Road is probably named, located the Portland Lode claim on 19 March 1896. That spring Wolf and J.W. McCann located the Iron Mountain Lode a short distance to the east. Those claims, along with the Lame Foot, Miner's Delight, Holyoke, Lucky Boy, Curlew, Enterprise, Lake Shore, Sunset, and William J. Bryan, were sold later that year to Jacob Goetz and Harry F. Baer (Quartz Record, Book D, pp. 78, 94-95; Mining Deeds, Vol. B, pp. 74-75, 115-118). In January and February 1898 the claims were surveyed by the federal government as Mineral Survey No. 406 (US Surveyor General 1898). Jacob Goetz and Co. were then issued Patent No. 30865 on 4 April 1899 and the property was transferred from the public domain to private ownership (Patent Book 1, pp. 41-45).

By the time they had acquired the Lamefoot claims, Jacob Goetz and Harry Baer had made fortunes in the Coeur d'Alene mines of north Idaho and their hotel and gambling establishment, known as the Coeur d'Alene Hotel, in Spokane. Although their activities on the Lamefoot claims are not known, the very limited amount of development during the historic period indicates more speculation on their part than serious attempt to develop the property. By ca. 1914 the claims were not mentioned in a summary of operating mines in the Belcher Mining District, in which the Lamefoot Project Area is located (Bancroft 1914: 166-79). Descendants of Jacob Goetz still own all of the mineral rights to the Lamefoot claims (Hunt 1992).

Conclusions

Development of the properties surveyed does not appear to threaten any significant cultural resources. None of the cultural resources observed on private lands during the survey appear eligible for inclusion in the National Register of Historic Places. While essentially intact, except for ore car track rails having been removed, the adit lacks any apparent historical significance. The remains of the air compressor building lack structural integrity as well historical significance. Likewise, the prospect pits lack any associated cultural materials likely to yield important historical information. Although the Lamefoot claims, patented as Mineral Survey No. 406, were associated with Jacob Goetz and Harry Baer, notable figures in local history, the property does not appear to have played a significant role in the individuals' careers as miners and businessmen.

References

Bancroft, Howland

1914 The Ore Deposits of Northeastern Washington. US Geological Survey Bulletin 550. Government Printing Office, Washington, D.C.

Fargo, Lucile F.

1950 Spokane Story: A Colorful Early History of the Capital City of the Inland Empire. Published under the sponsorship of the Eastern Washington State Historical Society by the Northwestern Press, Minneapolis, Minnesota.

Ferry County Auditor

n.d. Mining Deeds, Vol. B, pp. 74-75, 115-118. Ferry County Courthouse, Republic, Washington.

n.d. Patent Book 1. Ferry County Courthouse.

n.d. Quartz Record, Book D. Ferry County Courthouse.

Golder Associates, Inc. and Echo Bay Minerals

1992 Plan of Operations: Lamefoot Project 1992 Drilling. Submitted to the Bureau of Land Management, Spokane, Washington. March.

Hilderbrant, Rome

1992 Personal communication at the Lamefoot Project Area. April.

Holstine, Craig

1992 A Cultural Resources Survey on Federal Lands in the Lamefoot Project Area, Ferry County, Washington. Short Report 292. Archaeological and Historical Services, Eastern Washington University, Cheney. January.

Hunt, Walt

1992 Superintendent, Technical Services, Kettle River Joint Venture, Republic. April.

US Surveyor General

1898 Plat of the Claim of Jacob Goetz and Co. Mineral Survey No. 406. Approved 15 April.. On file in the Bureau of Land Management Office, Spokane.

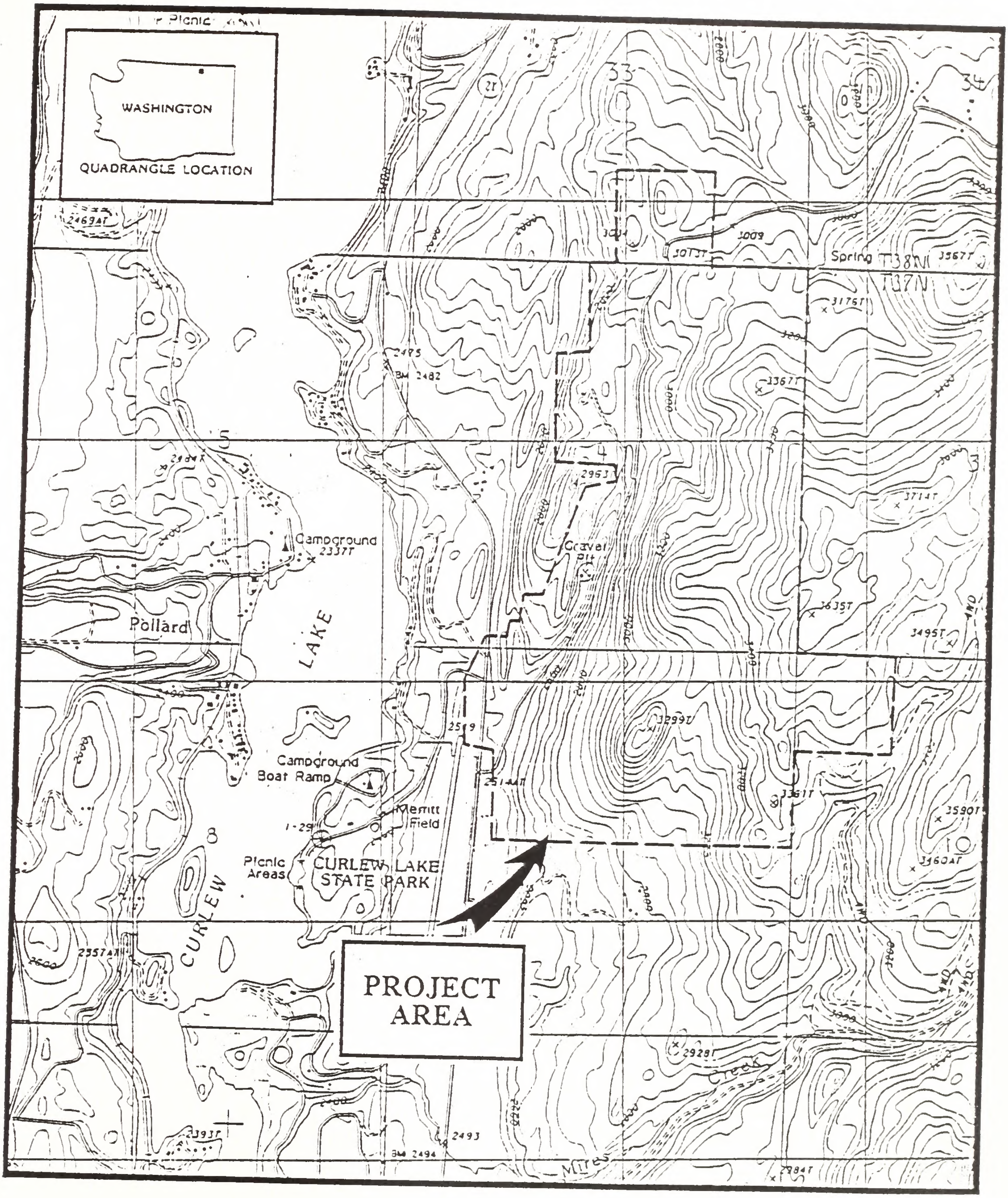


Figure 1. Lamefoot project area.

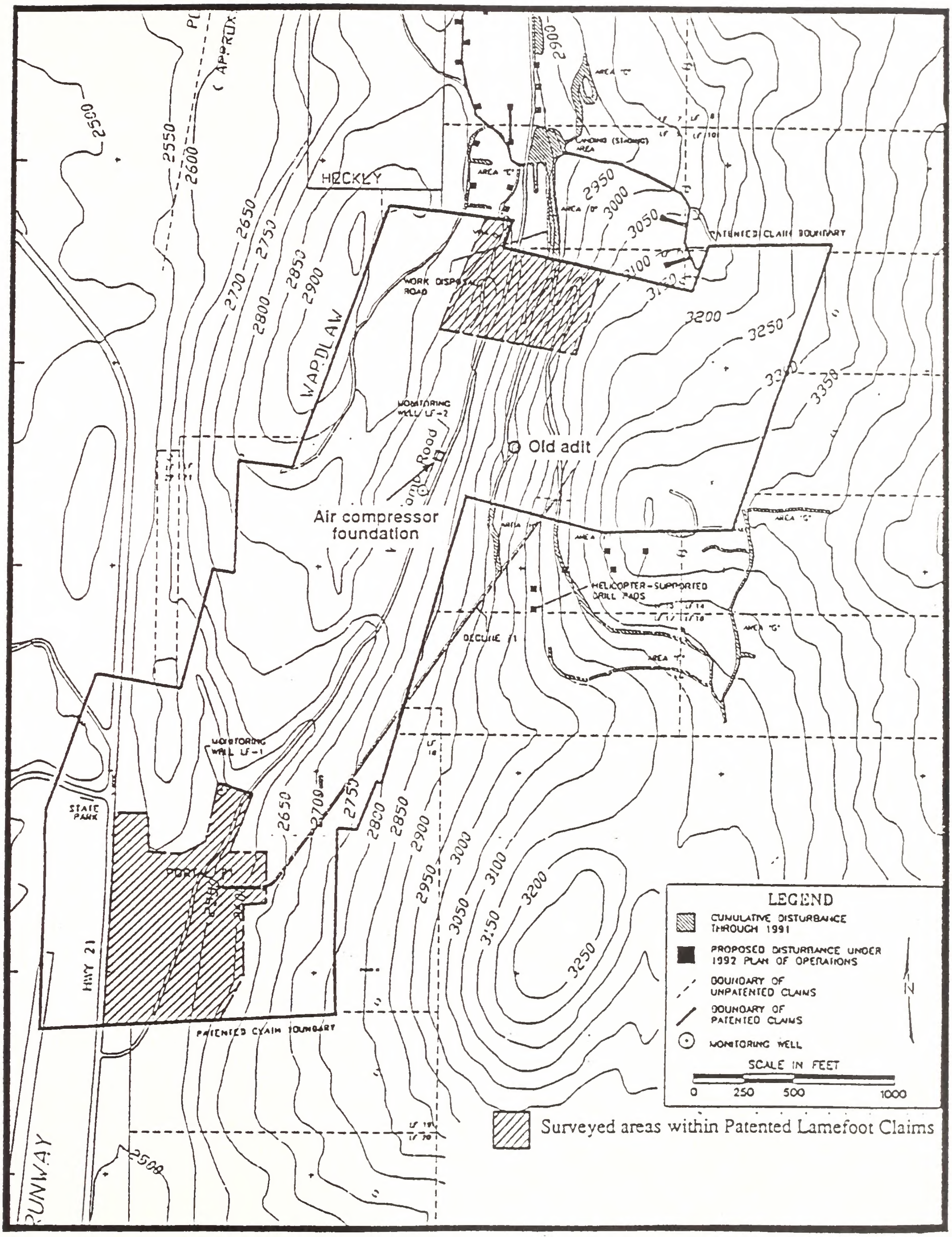

HECKLY
WARDLAW
Old adit
Air compressor foundation
Road
WORK DISPOSAL ROAD
MONITORING WELL LF-2
MONITORING WELL LF-1
HELICOPTER-SUPPORTED DRILL PADS
PATENTED CLAIM BOUNDARY
STATE PARK
HWY 21
RUNWAY
LEGEND
CUMULATIVE DISTURBANCE THROUGH 1991
PROPOSED DISTURBANCE UNDER 1992 PLAN OF OPERATIONS
BOUNDARY OF UNPATENTED CLAIMS
BOUNDARY OF PATENTED CLAIMS
MONITORING WELL
SCALE IN FEET
0
250
500
1000
N
Surveyed areas within Patented Lamefoot Claims

Figure 2. Areas surveyed and historic features examined within Patented Lamefoot Claims.

Appendix D

APPENDIX D

RECLAMATION PLAN FOR THE LAMEFOOT PROJECT

June 1992

923-2450

TABLE OF CONTENTS

RECLAMATION AND OTHER ENVIRONMENTAL CONSIDERATIONS

Page

1.0 PRECONSTRUCTION CONSIDERATIONS 1

2.0 SLASH CLEARING AND TOPSOIL STRIPPING AND SALVAGING 1

3.0 CONSTRUCTION METHODS 2

4.0 RECLAMATION 3

4.1 Road and Pad Reclamation 3
4.2 Drill Hole Abandonment 6
4.3 Reclamation of Disturbances Associated with Underground Exploration 6
4.4 Noxious Weed Control 7
4.5 Erosion Control 7

RECLAMATION AND OTHER ENVIRONMENTAL CONSIDERATIONS

1.0 PRECONSTRUCTION CONSIDERATIONS

It is Echo Bay's intention to reclaim disturbance where conditions and current reclamation technology permit and as required by the BLM. Echo Bay has developed a reclamation plan herein consistent with the long-term management objectives of the BLM.

General reclamation plans with regard to drilling activities on BLM-administered lands are similar to those already used by Echo Bay in past activities, and are discussed below as they pertain to road building, interim reclamation, and final reclamation of the drill roads, sumps, and drill pads. Reclamation recommendations presented here are, to the extent applicable and appropriate, based on information contained in the BLM Solid Minerals Reclamation Handbook (BLM Manual Handbook H-3042-1).

General reclamation plans for disturbances associated with underground exploration on private lands are briefly discussed in a separate section.

2.0 SLASH CLEARING AND TOPSOIL STRIPPING AND SALVAGING

In selecting the exact drill pad locations, Echo Bay will choose as many open areas as possible in order to minimize the disturbance to mature trees. Prior to topsoil stripping, any slash that may be present will be isolated, piled, and may be left in place for establishment of microenvironments for rodents and small mammals or may be removed per instructions from the BLM. If present, topsoil (growth media) may be stripped to a depth of 12 inches from areas of the roads and drill pads. It appears from existing soils information that most areas to be disturbed have some topsoil material that is at least marginally suitable for salvaging and redistributing. Assuming 12 inches of topsoil is available over the 2.42 acres of proposed

disturbance, a total of 3,865 cubic yards of material will be salvaged and stored in small stockpiles adjacent to each pad site or roadway. If topsoil is to remain in storage for a period exceeding six months, the stockpiles will be seeded with the seed mixture discussed in Section 4.0. In areas where topsoil is the only disturbed material, it will be stored in place as sidecast for reclamation with minimal surface disturbance.

3.0 CONSTRUCTION METHODS

Previously constructed drill roads with sidehill cuts were all constructed in a similar manner with the exception of the road in Area H. All of these roads were constructed using a D-8, D-7 or equivalent bulldozer. Running surfaces vary in width depending on the application. In areas where angle coreholes were drilled using a truck-mounted rig positioned perpendicular to the axis of the road, widths of up to 35 feet were required. Normal roads between drill sites and roads with sites requiring vertical holes typically range from 14 to 18 feet in width. Road widths at intersections are, of course, wider. In general, road widths were minimal for the operational requirements.

Construction of these roads was by a conventional sidecast method and the heights of cuts and size of sidecast was dependent upon slope steepness and road width. Typically, cuts do not exceed 6 feet (except Area H) although in the northern portion of Area F they are higher. Sidecast varies up to 20 feet along slope (except Area H).

Construction of the road in Area H incorporated blasting bedrock, sidecasting and construction of a safety berm on the downhill side. Much of the sidecast has been lost downslope due to steepness and blasting.

4.0 RECLAMATION

4.1 Road and Pad Reclamation

Reclamation of the Lamefoot drill sites and access roads will be performed incrementally. Any areas disturbed in 1992 that will not be needed for access to 1993 exploration activities will be recontoured and revegetated in the fall of 1992. Those areas likely to be needed for access to ongoing exploration and/or full-scale mining activities will not be reclaimed until those activities are completed. However, adequate drainage patterns and erosion control berms and water bars will be established on these unreclaimed areas so as to avoid undue degradation of the area.

A reclamation bond in an amount to be negotiated between Echo Bay and the BLM will be obtained by Echo Bay and processed in the appropriate manner, as specified by the BLM. The BLM will have access to release all or a portion of the bond upon satisfactory completion of either interim or final reclamation.

Ongoing reclamation is intended as the 1992 Lamefoot drilling program proceeds. Where possible, and as soon as possible, recontouring, retopsoiling, and revegetation will be conducted as per the BLM draft guidelines. The seed mixture proposed for use on the Lamefoot drill pads and roads was developed by project soils and vegetation specialists in consultation with BLM and USFS (Colville National Forest, Republic Ranger District) personnel. The seed mixture consists of:

►	5 lb/acre	Sherman Big Blue
►	8 lb/acre	Bluebunch Wheatgrass
►	8 lb/acre	Idaho Fescue

These species are native to the Lamefoot area and the BLM requires seeding with native species, using introduced species only if native species seeding is not successful. However, these species are slow to colonize and may not establish quickly enough when erosion control is the overriding concern in the first year or two of growth. Modification of the seed mixture may occur as recommended by the BLM, or the use of an annual cover crop such as annual rye may be necessary until native species are fully established.

The fertilizer recommended for use by the USFS on reclaimed sites in similar habitats is a 16-20-0-14 (nitrogen, phosphorus, potassium, sulfur) at the rate of 100 pounds per acre.

No new drill roads are currently proposed in steep terrain, so no significant cut or fill slopes will be created. Since all roadbed disturbances will be on relatively flat terrain, they will be reclaimed in a manner similar to drill pad sites.

Recontouring procedures for drill roads with cuts will be determined by the steepness of slope, height of road cuts and size of sidecast. On gentler slopes, where roads occur in unconsolidated material, a bulldozer (D-6 or D-7) will be used along contour to reshape cuts by pushing up sidecast. In areas of moderate slope, a track-mounted excavator with a 165 foot reach will pull up sidecast prior to reshaping with the cat. In areas too steep for sidehill operations of the cat, the excavator will place the material. Compaction will occur using the bucket in these cases.

These recontouring techniques will apply to previously disturbed Areas B, C, D, E, and F. Side cast overburden, when seeded, fertilized and mulched will support revegetation. Areas A and G will, for the most part, require no recontouring, but if a need is identified it will be done.

In order to reclaim area 'H' the process is more complicated. Initially the berm will be pushed to the inside of the road with a D-6 or D-7 cat. Then the excavation will pull sidecast onto the road. For safety reasons some areas of sidecast may have to remain undisturbed and this must

necessarily be at the discretion of the field operative and the equipment operator. The county road will be closed intermittently by flaggers during this operation to avoid the safety hazard of rolling rocks dislodged by the reclamation effort.

Next, the cat will return and push the reclaimed sidecast toward the end of the road, flattening it as required for subsequent steps.

Fill will then be brought in by dump trucks and placed by the excavator which will place fill and reshape the topography as best as possible along the road cut. This will be done in short increments no longer than the reach of the excavators' arm. When each segment is finished, growth media will then be brought in and placed in a similar manner. This procedure will be repeated until the entire road length on BLM is complete.

Complete recontouring to the original shape of the land may not be entirely possible for Area H but a best effort will be made within equipment and safety constraints.

Fill material will be composed of glacial gravel from our site construction or broken rock from our underground excavation, depending on availability. Growth media will be imported from our site construction on lower Wolf Camp Road. The thickness of growth media will be 6 inches to 1 foot depending upon availability and on coarseness of the fill material (coarser fill requiring more top cover). Seeding, fertilizing and mulching will be done by hand.

Prior to initiation of reclamation Echo Bay will notify the BLM so that a representative may be present.

Interim reclamation of some of the roads and pads may be advisable. Interim reclamation will consist of seeding with the approved seed mix. Final reclamation of drill roads subject to use during future exploration projects will be postponed until completion of exploration.

4.2 Drill Hole Abandonment

Completed drill holes will be abandoned using the methods specified by Washington state law to prevent commingling of groundwater and subsidence of the surface. Prior to capping, all holes will be filled with a drill hole abandonment fluid consisting of a premium-grade bentonite mixed to a +50 viscosity. The surface casing will be pulled or cut off, and the top 20 feet of the hole will be cemented. If artesian water is encountered in a hole, that hole will be cemented from bottom (T.D.) to top (the collar).

4.3 Reclamation of Disturbances Associated with Underground Exploration

As shown on Figure 3, a number of surface facilities will be constructed in association with underground exploration. This surface disturbance will be reclaimed at the completion of underground exploration if a decision is made not to go forward with full scale mine production. If a positive production decision is reached, disturbed areas will be reclaimed at the end of the project life.

In general, the disturbance areas identified in Figure 3 will be cleared and stripped of topsoil prior to any other construction activities. The topsoil stockpile location has been selected to prevent contamination of the topsoil resource, minimize wind and water erosion, and facilitate later reclamation activities. The topsoil stockpile will be seeded with a mixture of annual and perennial grasses which will germinate rapidly to provide a stabilizing cover to minimize erosion. The topsoil stockpile will be separated from active operations and any waste rock material. Upon decommissioning, stockpiled topsoil will be redistributed on the various sites prior to re-vegetation. The topsoil stockpile location is shown on Figure 3. Preliminary calculations estimate the volume of soil to be salvaged and stockpiled at 200,000 ft^3.

Upon completion of the project (be it after exploration or full-scale production), all disturbed areas will be recontoured to the approximate pre-mining topography, ripped, spread with topsoil, and seeded. Appropriate soil amendments and/or mulches will be applied.

The exploration adit, collared on private land but penetrating BLM land will be closed by a BLM approved method of portal closure as specified in the BLM Solid Minerals Reclamation Handbook H-3042-1.

4.4 Noxious Weed Control

Ferry County Mining Ordinance General Provision 3.02.1 states, "All exploration operations will comply with the requirements to control noxious weed infestation in accordance with the Rules and Regulations of the Ferry County Weed Control District".

Noxious weeds will be controlled throughout the life of the operation. Revegetated areas will be qualitatively evaluated on an annual basis to assess weed populations. A weed control plan will be developed in cooperation with the County Soil Conservation District. Noxious weeds on Echo Bay-controlled property will be selectively sprayed throughout the life of the operation to reduce populations in the area.

4.5 Erosion Control

Echo Bay personnel will monitor disturbed areas for erosion gullies. Any gullies discovered will be backfilled, hand compacted, and revegetated.

A series of best management practices will also be used to control erosion and sediment from disturbed areas. These may include silt fences, straw bale filters, living water bars or rock check structures. These structures will break up slopes and reduce surface water velocities to

inhibit erosion and remove sediment from overland flow before entering ditches. Slash rows at the fill toe may also serve this purpose.

Diversion ditches may collect flow from disturbed areas and control velocity and reduce area affected by surface flow. The ditches may contain such sediment control structures as rockfill sediment barriers or sediment traps. A system of drainage control structures will divert surface runoff from lower Wolf Camp Road into a settling infiltration pond as shown on Figure 3.

Revegetation will take place as soon as practicable after disturbance. Echo Bay personnel will monitor the area for erosion and slope stability. Erosion control or slope stabilization will be implemented as necessary. Any structures installed will be subject to periodic maintenance as may be necessary.